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COMMISSION OF INQUIRY INTO THE
USE OF DRUGS AND BANNED PRACTICES
INTENDED TO INCREASE ATHLETIC PERFORMANCE

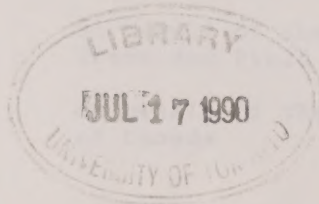
B E F O R E:

THE HONOURABLE MR. JUSTICE CHARLES LEONARD DUBIN

HEARING HELD AT 1235 BAY STREET,
2nd FLOOR, TORONTO, ONTARIO,
ON TUESDAY, AUGUST 1, 1989

VOLUME 67

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C O U N S E L:

R. ARMSTRONG, Q.C. Ms. K. CHOWN	on behalf of the Commission
R. BOURQUE	on behalf of the Canadian Track and Field Association
J. DePENCIER	on behalf of the Government of Canada
T. BARBER R. MORROW	on behalf of the Sport Medicine Council of Canada, and Professors Dugal and Donike
R. McCREATH	on behalf of the Canadian Olympic Association
A. PRATT	on behalf of Charles Francis
Ms. L. FUTERMAN	on behalf of Ben Johnson

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--- Upon commencing.

THE COMMISSIONER: Before continuing the public hearings of this Inquiry, I thought it might be appropriate to make a brief comment on the work of the Commission since our last recess.

We have to date had 66 days of public hearings and have called 80 witnesses, which I think is quite a remarkable achievement largely as a result of a very careful and thorough preparation of Commission staff and counsel.

During the interval, the work of the Commission has been carrying on in preparation for the continuation of the public hearings and of equal and perhaps more importance addressing other broad issues raised in our mandate, which are not properly the subject matter of a public hearing, but which have become a very important part of the work of the Commission and of my report, which is to follow.

During the recess, I also took advantage of a prior speaking engagement which I had in Cambridge University at the International Law Conference to meet with senior sports officials in the United Kingdom who were present at that time and a review with them the steps being taken internationally to eliminate the use of enhancing performance drugs and other banned practices in

athletic competition.

By happy coincidence, Mr. Armstrong was a delegate to the conference and had to subject himself to my learned words at that time. But together we were able
5 to meet a great number of people in the United Kingdom through the good auspices of the British Sports Council, which is the counterpart of Sports Canada. A series of meetings was set up for Mr. Armstrong and myself, which literally lasted from 9 a.m. to midnight on many days.

10 We met with the officers of the British Sports Council and their chief doping control officers. We also met Dr. Beckett, who as you may have heard already is a leading authority on steroids and other practices, a leading biochemist, a former head of the IOC accredited
15 lab in the United Kingdom. We met with his successor, Professor Beckett, who is still an IOC Medical Commission member.

We also met with Professor Brooks, a leading biochemist, who I think is responsible for the procedure
20 now in practice of detecting anabolic steroids and tests being made following competition.

We also met with the representatives of the British Olympic Association. Sir Arthur Gold who is the president of the British Olympic Association, with the
25 chief medical officer and chief doping control officer.

We also met with the representatives of the IAFF-RIAAF, who are headquartered in London, England with their officers and with their chief doping control officer as well.

5 Mr. George Chuttleworth (phon), who is the director general of New Zealand Sports Council who happened to be in London at the time and I was able to meet with him.

10 And also Mr. Samaranch, who is the President of the IOC, was also in London, and I met with Mr. Samaranch for some length.

15 Of course, I was interested in steps being taken on the international scene to eliminate the use of enhancing performance drugs and other banned practices, which if left unimpeded was recognized to be a threat, a direct threat to the future of international Olympic competition throughout the world.

20 I must say, and I don't want to appear immodest, but I was surprised and encouraged by the very close attention which has been given to the work of this Commission by all those with whom we met.

25 Although there has been concern for many years about the use of enhancing performance drugs and other banned practices, it was hard to stimulate aggressive action and to warrant expense when the

indication was apart from the disqualifications which were disclosed. It is mostly be said to be rumour and gossip as to the true extent of the use of anabolic steroids in international competition. It was hard to amount
5 aggressive and stern action in the absence of direct evidence and proof of the extent of the use of anabolic steroids not only in Canada but in the global sense.

We are complimented by everybody we met by being able to prove by hard evidence the extent of the use
10 of anabolic steroids and other banned practices, not only in Canada but in all countries principally, who were engaged in international athletic competition in a serious way. And that, I think, has stimulated action which had been attested to by words alone in the past, in to what I
15 think is now a sincere and direct effort to eliminate these practices.

We discussed with all those we met the steps being taken and being proposed in various sports federations, including the IOC. And we will hear more of
20 that later in my report.

I have some reservations with respect to some of the proposals being made and the manner in which they are expressed, by particularly the IAAF, which I fear may be misconceived and counter-productive, and which I
25 will have further comment to make at the appropriate time,

but subject to that, I am encouraged by what I believe to be the very strong steps being taken and the dedication of all those throughout the world who were interested in restoring athletic competition to its high noble objectives and create a healthy climate, a drug-free climate for future international competition which we hope follows presently.

My trip to England followed an earlier trip I made to Washington in the United States where I met with representatives of the Senate Sub-committee on Justice headed by Senator Biden, of the House of Representatives Sub-committee on Justice headed by Congressman Hughes, and with their staff.

We also met, Mr. Nunn was with me at that time, with all the senior law enforcement officers in the United States.

There are many proposals for amending the laws relating to anabolic steroids in the United States, both on the Federal and State level. Some were amended as recently as 1988. There is no direct Federal vestment in sports by the Federal Government of the United States or by State. There is no such thing as Sports America. Therefore, the government agencies are not directly interested in matters such as doping control in athletic competition. But because of the increasing awareness of

the very serious side effects of the health of those who are using these banned drugs, the extent of their use, and the nature of their use, not only by those engaged in athletic competition, but by others, both the Congress of the United States and every state practically in the United States is addressing the issue of the use of steroids to what I might call criminalizing that use.

And we have been afforded the material of the United States both on the Federal and State level of steps being taken in the United States to amend the laws relating to the use and possession of anabolic steroids.

At the very commencement of this hearing, I indicated that I was interested in reviewing our own Food and Drug Act, which controls the use of these steroids, and I found the trip to the Washington particularly helpful in aiding us in that review.

In addition to the work of the IOC and the International Sports Federations, considerable advancement made on what I call a government-to-government basis to address this serious issue. I am proud to say that Canada has been the forefront on the government-to-government basis of seeking international cooperation to eliminate the use of drugs and other banned practices in sport.

You recall I mentioned that in June of last year, Canada convened the first international conference

to seek a charter for the elimination of such drugs and banned practices, and much progress has been made since that day.

5 There have been conferences in Monte Carlo; and Reykjavik, Iceland which the Government of Canada played an important part. There is a conference in Moscow, which is hoped the culmination of the work will be achieved at that time. The meeting is to be in October.

10 So, much progress is being made both on a sports federation basis and a government-to-government basis as these hearings continue.

 In addition, various sports federations on their own have begun to initiate a form of random drug testing within their own federation.

15 This week I think we will hear from additional evidence to the extent of the use of anabolic steroids in intercollegiate football. It is not without some significance that the Big Ten Conference in the United States, one of the most football conferences in the United States college competition, have just announced a
20 program of random testing for steroids amongst their football players.

 On another note, since our last hearing Michel Proulx, who is our co-counsel with Mr. Armstrong
25 has been appointed to the Court of Appeal of the Province

of Quebec. What is a great gain for the province and for Canada to have a leading member of the bar assume additional responsibilities, of course, is our loss.

5 The way I had assigned the work of the Commission, Mr. Proulx was responsible for much of the work which has yet to be heard. And we lost him, unfortunately, at a very inopportune time for us, but these matters cannot be changed. And I have asked Mr. Armstrong and Ms. Chown to assume his responsibilities,
10 which will, of course, result in some short delay while they get a chance to interview and speak to all the witness that Mr. Proulx was otherwise to call.

I better finish these hearings in a hurry or otherwise we are liable to lose Mr. Armstrong and Ms.
15 Chown. I will be left all alone.

Well, those are all the preliminary matters that I would like to address this morning, and I will call on Mr. Armstrong to introduce this phase of the inquiry.

MR. ARMSTRONG: Thank you, Mr.
20 Commissioner.

I thought it might be helpful to you, sir, and to our colleagues representing various interested parties if I took a moment to indicate to you what we have scheduled for this week and for the days ahead after this
25 week, if I may just take that moment.

5 This week, Mr. Commissioner, we are going to hear from three witnesses who have devoted much of their professional lives and time to what I would call medical testing, and that's probably far too narrow a description, but with apologies to them.

10 In any event, this morning I intend to call Professor Robert Dugal who is director of the IOC accredited lab in Montreal. He will be followed by Professor Donike, who is the director of the IOC accredited lab in Cologne, West Germany. And I anticipate, although I haven't had final confirmation, that a third witness in this grouping will be Dr. Donald Catlin, who is head of the IOC accredited lab in Los Angeles.

15 When those three witnesses are finished, we expect to hear from one remaining track and field athlete, Miss Linda McCurdy-Cameron, who is a Canadian high jumper, followed by two or three witnesses from the sport of bobsledding. And then finally we hope to finish the week on Thursday or Friday with a number of, as you have indicated, intercollegiate football players.

20 The next grouping of witnesses that we anticipate calling will be from the sporting organizations which govern track and field. And we had originally scheduled those witnesses, in fact, to proceed on August 25 the 7th, but because of the change that developed as a

result of Mr. Proulx's appointment to the Court of Appeal,
at our request and the agreement of the CTFA, the
witnesses who were to be scheduled for August 14th, as it
has turned out the CTFA witnesses more than half of them
or nearly half of them are simply unavailable during the
week of August the 14th. One of the reasons being that
the Canada Games are being held that week.

So, our plan would be to sit the week of
August 21st beginning with two representatives of the
Ontario Track and Field Association, followed by a number
of representatives of the Canadian Track and Field
Association.

We then hope to schedule some witnesses
during the week of August 14th so as not to lose that
week, although I don't think we would take the entire
week, but we may, subject to availability, be able to
schedule a representative from the CIAU, the Canadian
Intercollegiate Athletic Union, who will speak to, testify
to the issues related to doping control in intercollegiate
sports.

Also that week it is possible if the people
are available to hear perhaps from representatives of
Sport Canada, the Canadian Olympic Association, and the
IOC.

Again, you will see a cluster of witnesses

to use the word that appeared in these hearings early on,
a cluster of witnesses dealing with sporting organizations
and their responsibilities that they assume not only for
general matters related to sporting organization, but in
5 respect of doping control and the eradication of drug
abuse. Our interest would be obviously focused there.

Although not yet scheduled as to a
particular date, but we will clearly have available for
you, sir, some evidence related to distribution. You have
10 heard some already, but our staff is busy organizing a
group of witnesses who will testify as to the distribution
of steroids I believe both in Canada and elsewhere which
we hope will provide a significant factual base for your
consideration in respect of what ought to be done in
15 respect of the Food and Drug Act.

So, that is the current plan. I apologize
to you, sir, and to others for not being able to be more
specific in terms of time, but we clearly have this week
fully scheduled. We clearly have the week of August 21st
20 fully scheduled.

THE COMMISSIONER: It is very difficult to
arrange witnesses during what is normally a vacation
period anyways.

MR. ARMSTRONG: There is, of course, that
25 additional feature that many of these witnesses have given

up considerable time and will give up considerable time,
and it is a little difficult to phone somebody and say,
look, we would like to now change you from such and such a
date to another date in August. And they say, well, you
5 know, we plan to take the children to Banff, and are you
really going to require me to come.

THE COMMISSIONER: Let's go there and
continue the hearings in Banff.

MR. ARMSTRONG: In any event, we will
10 pursue that course.

Let me take a moment just to tell you a bit
by way of outline of the evidence that I anticipate this
week.

As I indicated, our first witness will be
15 Dr. Robert Dugal, a Director of the IOC accredited lab in
Montreal. We have heard much evidence so far about the
Sports Medicine Council of Canada, its doping control
program, if I can put it that way in the broadest terms,
its relationship to the Montreal lab.

20 You are now going to hear from the witness
who deals with the Sports Medicine Council of Canada and
the operation of the lab. And he is going to take some
time to describe that to you, the relationship that he has
with the Sport Medicine Council of Canada, and through the
25 Sports Medicine Council of Canada, Sport Canada.

He will speak to the question of what the capacity of that lab is, both to deal with testing at the present time and perhaps testing in the future.

5 We had promised you, sir, that when we called our initial witnesses during the first session in January that we would revisit in a little more detail the pharmacology and science of anabolic steroids. And you may, in fact, already have through osmosis and through the witnesses that you have already heard feel that you are
10 entitled to your PhD already.

THE COMMISSIONER: Well, Dr. Soloman has also been giving me instructions, of course, and he is here today.

15 MR. ARMSTRONG: That's right, and one of our distinguished experts, as you pointed out, sits behind me, but I do intend nevertheless to keep the promise. And Dr. Dugal is going to take a moment or two just to revisit the pharmacology and science of anabolic steroids, to put the evidence for the week in context.

20 He, as well, is going to describe in some scientific detail the methodology of testing. And I can tell you right now that I found out that I thought I understood the subject, I don't, and if you --

THE COMMISSIONER: That doesn't surprise
25 me.

MR. ARMSTRONG: If you at the end of Dr. Dugal's evidence fully understand it, then Dr. Dugal is going to be nominated for a Nobel Laureate prize.

THE COMMISSIONER: I want to think about that.

MR. ARMSTRONG: In any event, we think it would be useful if we had on the record, and useful for you, sir, if Dr. Dugal took a half an hour or so with a series of slides that he has just to explain a number of the things that we have already heard much about, but to have that information available on the record.

So, there are some other subjects that I will be exploring with Dr. Dugal, but that basically is the nature of his evidence.

Then Dr. Donike will really speak to two broad general subjects. First, the IOC Medical Commission, what it is, what its set up is. He will speak to the question of the accreditation of the IOC medical laboratories around the world, the re-accreditation of those laboratories, and generally the set up internationally as is organized by the IOC.

As well, Dr. Donike will deal with the events in Seoul, the test results there, not only the test results of Ben Johnson, which we have never filed, but we now intend to file those test relates so they are here and

available and on the record, but also he will be able to provide us with information concerning the test results generally.

5 I should here pause and say that originally we had requested of the IOC Medical Commission that we have Dr. Park come and testify in respect of the Seoul test results, and the Chairman of the IOC Medical Commission, Prince de Merode, has designated Dr. Donike to be the spokesman for the IOC Medical Commission. And so,
10 he will deal with those results in Seoul.

And then, thirdly, Dr. Catlin, as I have indicated I don't have final confirmation from him as to his precise availability. There was some problem with his schedule this week, but he was going to do his best to be
15 here to follow up Dr. Donike. He, I anticipate, will speak to the United States situation generally in the areas that are within your mandate and are of interest to us.

He will then I expect speak to the
20 international scene, and, particularly, what has transpired with the United States-USSR bilateral agreement and what steps are being taken to implement it.

He has advised me and I hope will be able to tell you that there are already some steps in progress to
25 implement that bilateral testing agreement between the

United States and the USSR.

Dr. Catlin is as well an expert in these areas of testing, is as well a physician, an internist and has some very particular views about the medical side effects. And I haven't yet reviewed that evidence with him, although I have briefly, but I expect he may well be able to assist you in that area as well.

So, that roughly is what we plan to cover in the next two or three days.

THE COMMISSIONER: Very well. Thank you.

MR. ARMSTRONG: If I may then, Professor Dugal is ready to be sworn.

ROBERT DUGAL: Sworn

--- EXAMINATION BY MR. ARMSTRONG:

THE COMMISSIONER: Thank you, gentlemen.

MR. ARMSTRONG:

Q. All right. Now, Professor Dugal, I am going to take a few moments with you to review your academic and professional background. I have placed with you, sir, a copy of Professor Dugal's CV and also a couple of copies with the Registrar, and I would ask that his CV be marked as the next exhibit.

THE COMMISSIONER: Thank you.

THE REGISTRAR: 212, Mr. Commissioner.

THE COMMISSIONER: Thank you.

--- EXHIBIT NO. 212: CV of Professor Robert Dugal.

5

MR. ARMSTRONG:

10

Q. All right. Dr. Dugal, you received your Bachelor of Arts degree from the University of Montreal in 1961, followed by studies for your Bachelor of Science degree from the same university, which was awarded in 1965; is that correct?

A. That is correct, yes.

15

Q. And then you went off to the University of Wisconsin in Madison, Wisconsin, where you studied pharmaceutical physical chemistry, and received your MSc. from that university?

A. That is correct, yes.

20

Q. Then from 1970 to '73 you pursued doctoral studies at the University of Montreal in the Faculty of Medicine and Faculty of Graduate studies receiving in 1973 your PhD in pharmacology?

A. That is correct, yes.

25

Q. And then looking at page three of your CV, in your professional background just touching on some of the highlights, from 1969 to '70, you were senior

lecturer at the Faculty of Pharmacy, University of
Montreal; is that correct?

A. Yes, it is.

Q. Then from '71 to '73 you were Vice
5 President and Director of Pharmaceutical Services with a
company called Bio-Pharm Inc. in Montreal?

A. That is correct, yes.

Q. Then from 1973 to 1978 you were the
Associate Professor of the INRS Sante Research Center, a
10 research center of the University of Quebec located in
Montreal?

A. That is correct, yes.

Q. Then from '78 to the present you have
had the academic designation of full professor associated
15 with the same institution at the University of Quebec?

A. Yes, sir.

Q. Then in 1979 you became the director of
the INRS Sante Research Center in Montreal, University of
Quebec.

20 THE COMMISSIONER: What does INRS stand
for?

THE WITNESS: It is the French acronym for
National Institute for Scientific Research. In French
Institute National de la Recherche Scientific.

25 THE COMMISSIONER: Thank you.

MR. ARMSTRONG: Then, Mr. Commissioner, turning over a few pages to page five, I want to review some of the highlights of Professor Dugal's commission and committee work at the national and international level.

5

MR. ARMSTRONG:

Q. First of all, from 1973 to 1976, you were the Director of the Doping Control Program for the 1976 Olympic Games in Montreal; is that correct?

10

A. That is correct, yes.

Q. From 1977 to 1980 you were a member of the Scientific Group, Medical Commission of the International Olympic Committee in Lausanne, Switzerland; is that correct?

15

A. Yes, I was.

Q. And from 1978 to '80, you were Director of Drug Research and Testing Program, Lake Placid Organizing Committee for the 1980 Winter Olympic Games in Lake Placid, New York. And I take it what that title indicates is that it was your laboratory in Montreal that did the testing for the Winter Games in Lake Placid in the winter of 1980?

20

A. As well as the research that was necessary to implement the programs in the two years before the games themselves.

25

Q. All right. And just pausing there for a moment, how did you do that? You are not far from Lake Placid in Montreal. Was the testing actually, the analysis and screening and so on, was that actually done in the lab in Montreal or did you actually set up a lab down in Lake Placid?

A. We actually moved the Montreal facility to Lake Placid.

Q. All right. And then in 1980, you became a member of the sub-commission of the IOC Medical Commission, the sub-commission being the sub-commission on doping control and sport biochemistry; is that correct?

A. That is correct, yes.

Q. One often refers to you and Professor Donike and Professor Catlin and Professor Beckett as in fact being members of the Medical Commission, and in a way you are, but your actual membership is through this sub-commission on doping control and sport biochemistry?

A. Well, actually there are four sub-commissions, and five -- there are five or six members in each one of them and. The members of these sub-commissions as a whole constitute the IOC Medical Commission, plus other individuals that are present for a total of about 30 to 32 persons.

Q. All right. And then, Mr.

Commissioner, turning the page over to page 6, taking some of the highlights there.

In 1985 I note you were the Canadian delegate serving in an observer capacity to the experts' group on doping for the committee for development of sport for the Council of Europe in Strasbourg, France?

A. My role was that, and has been since then, of scientific advisor, if you wish. My status is not really clear in the sense that I accompany Mr. Sorenson, notably, to the sessions of this particular committee in Strasbourg, France. I act in the capacity of scientific advisor, if you wish.

Q. We, of course, have heard from time to time and the evidence here that Fitness and Amateur Sport and the Canadian representatives have been invited on a fairly frequent basis to participate as observers in the discussions of the Council of Europe. So, I take it you go along with the Canadian delegation on those occasions?

A. That is correct, yes.

Q. All right. And then from 1986 to the present, you have been a consultant to the drug testing committee of the National Collegiate Athletic Association of the United States?

A. That is correct.

Q. And from 1987 to the present, you are a

member of international working group on anti-doping in sport, which is a group including representatives from Canada, East Germany, the United States, Norway, Soviet Union, and the Council of Europe.

5 I take it that's the working group that got going to do the initial spade work on the First Permanent World Conference; is that it?

A. That is correct.

10 Q. And that group still survives and presumably you are working visibly on the Second Permanent World Conference which is to be held in Moscow in October?

15 A. Not only survivors, but it's very active. It has met at least four or five occasions in the last year or so. And, of course, is very active in putting together a program for the next Second Permanent Conference in Moscow as you mentioned.

20 THE COMMISSIONER: That's in October, as you mentioned.

THE WITNESS: That is mid-October, yes.

20 THE COMMISSIONER: Thank you.

MR. ARMSTRONG:

25 Q. And then, Professor Dugal, you were, of course, a member of the advisory committee of the First Permanent World Conference in anti-doping in Ottawa in

June of 1988. Moving further along, in 1989, you were the Chairman of the Medical Commission for the first Francophone Games which were just held in July in Morocco?

A. That is correct, yes.

5

Q. And just pausing there for a moment if I can. Canada had representatives at the Francophone Games and, in fact, had three teams as I understand it. A Canadian team, Quebec team, Quebec Canada Team and a New Brunswick Canada team; am I right?

10

A. That is correct, yes.

Q. And I take it by that that the model in a sense is a bit like the Commonwealth Games?

15

A. It is a bit like the Commonwealth Games since the countries participating in the Commonwealth Games are mostly English speaking. These games, the first Francophone Games, were established as part of a greater collaboration, if you like, between French-speaking countries, north and south.

20

Q. All right. And just again pausing --
THE COMMISSIONER: Just out of a matter of interest, how many countries were represented at the Francophone Games?

25

THE WITNESS: Theoretically there are 43 French-speaking countries in the world; I believe there were 41 represented.

THE COMMISSIONER: Forty-one teams at the Games.

THE WITNESS: Yes, approximately 2,000 athletes.

5

MR. ARMSTRONG:

Q. And the Francophone Games that were held in Morocco, what laboratory facilities did you use there for your testing of samples?

10

A. Well, for purposes of practicality, we used the IOC accredited lab in Paris.

Q. I see.

A. The samples were shipped daily to the Paris lab for analysis.

15

Q. What is the turn-around time? What's the flight from Morocco to Paris?

A. It is about three hours. We had to surmount a few problems like the Moroccan and French Customs, because the samples had to arrive at the lab in a sealed condition. The turn-around time was about 48 to 72 hours. It was acceptable under the circumstances.

20

Q. And did the same sort of situation obtain in Morocco then that if an athlete -- what happened if an athlete tested positive or what was the plan in the event that an athlete -- I guess that's not the correct

25

terminology to say an athlete test positively.

Assume that you got a positive result on the A sample, what was the arrangement for the athlete or his representative concerning the analyzing and testing of the B sample?

A. Well, the rules were quite clear and they were patterned after those of the IOC which were used notably in Seoul. The athlete was entitled to representation. He was entitled to be present if there was a positive case. And his representatives also were to be present.

THE COMMISSIONER: In Paris?

THE WITNESS: In Paris, yes. The athlete also got the choice of having a representative from the -- his embassy in Paris or Consulate, as the case may be, to be present at the lab to representative him.

THE COMMISSIONER: Would you have any positive tests in Morocco?

THE WITNESS: We had one potential positive, that is an A positive sample, which remains to be confirmed. It is not a positive sample since the B analysis has not been performed.

THE COMMISSIONER: I understand there is no finding, but the -- as a result of one -- an A sample, a B sample is being tested, is that right?

THE WITNESS: The B sample will be tested next week, yes.

THE COMMISSIONER: All right.

5 MR. ARMSTRONG:

Q. Then in 1989 I note from your CV that you are listed as a member of the International Olympic Anti-Doping Commission of the International Olympic Committee. And can you just tell us what that is.

10 A. The International Olympic Anti-Doping Committee is at the present stage a proposal that has been accepted in principle by the IOC executive board at its April meeting in Barcelona.

15 This part of the Commission has for objective to establish an international doping control system under the auspices of the IOC, but at the present stage, as I indicated to you, it is a proposal. The composition is not yet final. Certain representatives from international federations and from NOC's and so forth remain to be named.

20 We expect the final composition first, and then implementation of the work of this particular Commission to begin after the IOC session in Puerto Rico at the end of this month, as well as after the Second Permanent Conference to be held in Moscow in October.

25

Q. All right. Then somehow in going over this list, Mr. Barber has pointed out to me that I have missed your involvement with the Sports Medicine Council of Canada. And we certainly have heard from time to time that you have been actively involved in at least an advisory capacity with the Sports Medicine Council of Canada. And we have already heard from Dr. Pipe, whose the, I believe, the Chairman of the -- I never know the name because it is so long, I can't always remember it, but in any event you are a member, I take it, of what I call the anti-doping committee, anti-doping advisory committee of the Sports Medicine Council of Canada?

A. Yes. I am an ex-officio non-voting member.

Q. As I understand it, you have been associated with that committee since it was first set up under the chairmanship of Dr. Gledhill of York University?

A. That is correct. That was back in late '83 or early '84.

At that time I was a full member of that committee, but I became ex-officio after a little while, eight or nine months, because a contract was signed between the SMCC and the institute. And there is apparently a by-law in the constitution of the SMCC that forbids people who are receiving contracts or grants to be

voting members of such committees. So, I became ex-officio at that time.

Q. All right. Now, let's take a few moments, Professor Dugal, to talk about the INRS Sante Laboratory in Montreal. First of all, you are associated with the University of Quebec, as I understand it?

A. That is correct. The institute as a whole is part, integral part, of the University of Quebec Research System.

Q. Yes. And the University of Quebec has six other research centres located around the Province of Quebec?

A. The INRS has six other research centres located in various geographical areas. We have in Remouski, for example, in northeastern Quebec, a center called INRS Oceanography, which is interested, of course, in the problems related to salt water.

There are two other research centres in Quebec City, which are respectively involved in mine resources, mineral resources. And a second one is involved in water resources.

And we have four research centres in the Montreal area. Sante, of course, which is the health science research center. There is a telecommunication research center also which works closely with Bell

Northern Research Laboratories on Nun's Island.

A third one involved in urban resources in Montreal. And finally, a fourth one located in Varennes, Quebec, involved in energy resources, solar energy, replacements energies and so forth, working closely with the Hydro Quebec Research Institute.

Q. All right. Now, taking your laboratory in Montreal, I believe you carry out a number of research programs. And can just take a moment just to describe those programs.

A. Certainly. We have four active research programs. The first one which --

THE COMMISSIONER: This is in your lab now in Montreal?

THE WITNESS: That is correct, yes, in the research center itself. Four research programs. You know, the health science research is a wide field, and we try to focus on certain number of areas to trying not to duplicate which is being done by others.

The first program is called, appropriately enough, Health and Safety in Sports. And it is in this context that we do drug testing for the SMCC and Sport Canada.

That program is partly involved at the research level in pharmacological studies and drug

laboratory studies, as well as refining of techniques used in the detection, and so forth.

A second program is called Medicine Chemistry. Here we -- and I am not directly involved in
5 that particular program, but this, very briefly, focusses on chemistry and pharmacology.

We have a third program called Environmental Toxicology, which essentially interests itself to the degradation of persisting pollutants, such as
10 polycarbonated biphenyls and polyaromatic hydrocarbons.

And finally a fourth program which we have initiated about five years ago focusses on the molecular biology and genetics of Alzheimer's disease.

Q. Going back to the research program that
15 carries the title Health and Safety in Sports, we know that he you have done much work and we will hear about it in connection with the detection of certain banned substances, particularly anabolic steroids. What work, if any, are you doing in developing techniques for the
20 testing of other banned substances, and in particular, I have in mind are you doing any work on a test for the detection of blood doping? Are you doing any work on a test for the detection of human growth hormone?

A. One of my senior faculty members is
25 actively involved, or has been recently actively involved,

in attempting to devise a test, a suitable test, for the detection of exogenously administered human growth hormone.

5 The program is still in its infancy, and it is a very difficult problem, but we are addressing ourselves very specifically to it.

We also entertain an active collaboration with another university in Quebec in order to develop a suitable test for blood doping as well.

10 THE COMMISSIONER: Where is that being done, Doctor?

THE WITNESS: That is being done at the University du Quebec at Trois Rivieres. Three Rivers is a small city, north --

15 THE COMMISSIONER: Are you aware of the work being done in other jurisdictions, say on human growth hormone, or other countries addressing the issue as well? What about the United States or Europe?

20 THE WITNESS: There may be some research being carried out in the detection of growth hormone in other countries but -- specifically in sports, but right now it does escape me, really.

THE COMMISSIONER: All right. Thank you.

MR. ARMSTRONG:

Q. All right. Do I take it that up to the present time it is indeed not possible to detect whether an athlete has taken human growth hormone?

5 A. Oh, human growth hormone or hormones are detectable. What we cannot determine is whether what is detected is the result of exogenous administration or not.

10 THE COMMISSIONER: It can be natural, in other words?

THE WITNESS: That's right. The problem is that the secretion of growth hormone is influenced by quite a number of factors. Drugs, some drugs increase significantly the secretion of growth hormone. Exercise does it. Sleep increases the secretion of human growth hormone.

THE COMMISSIONER: Is that good or bad?

20 THE WITNESS: That's good, I guess, but the end result is that the concentration which would be determined in blood is absolutely meaningless until the further biological factors are elucidated. It is not an easy problem.

MR. ARMSTRONG:

25 Q. All right. Now, what about blood

doping. We have had some evidence here, I believe from Dr. Gledhill, that perhaps one of the Scandinavian countries had at least developed a test which he described as 50 percent efficient. I think he indicated that if you took 10 people who had taken -- who had been involved in the practice of blood doping, that the test is at least good enough to pick up five out of the ten; and he also said that if you took ten people who hadn't, there would be no false positives.

So, it was at least 50 percent efficient. How far has your work advanced in terms of -- are we on the threshold of being able to detect 100 percent of the cases or --

A. I wouldn't say we are on the threshold, but there is certainly good hope with the kind of approach that we are trying to exploit to have a workable test. I cannot really give you a date. Your crystal ball is probably as good as mine. I really don't know. But hopefully, with the research which is going on in Scandinavia, and what we are doing and what other people are doing, a workable test may be available for blood doping in a short to medium term future.

Q. Now, let me ask you a little bit about the work of your lab so far as it relates to the testing of banned substances on the IOC list. How many people in

your laboratory are involved in this work?

5 A. Directly and indirectly, there are approximately 25 to 30 people involved in drug testing and related research. Let me try to qualify that for the moment.

I have three senior faculty members which are involved in one area or the other of development-drug metabolism studies, and so forth.

10 There is a number of research associates, assistants and technicians which are involved in testing and research at the same time depending on the through put to the flow of samples to the lab; and finally, we have some four or five people involved in a support capacity: computer analyst, librarian, service engineer for
15 equipment maintenance, and so on and so forth. So, approximately 25 people.

Q. All right. Then let me ask you a little bit about your clientele, if I may. We, of course, know about your contract with the Sports Medicine Council
20 of Canada. And if we were to take the current year, and I forget, do you operate on the government's fiscal year, April 1st to March 31?

A. Yes, we do. We receive a grant on that basis indeed.

25 Q. All right. So, if you were -- if I

were to ask you then, from April 1, 1988 to March 31, '89, how many tests did you perform for the Sports Medicine Council of Canada under your contract?

5 A. I don't have the exact figure, but it is in the neighborhood of 1,000 tests.

Q. All right. And then in addition to the contract that your lab has with the Sports Medicine Council of Canada, what other groups, organizations, do you provide testing services for in regard to -- in the athletic area?

10 A. Our like largest "client," if you wish, is the NCAA, the National Collegiate Athletic Association, in the United States for which we perform an average -- or we have been performing in the last two or three years an average of 1,500 to 1,700 samples a year.

15 Q. All right.

THE COMMISSIONER: That's the NCAA?

THE WITNESS: Yes.

20 MR. ARMSTRONG:

Q. What sports have you been testing for in the NCAA?

25 A. All of them, I believe, but mainly of course football, but we have tested swimming, diving, track and field, baseball, and so and so forth. All

NCAA-sponsored sports.

Q. All right. What other organizations do you test for at the present time? We have Sports Medicine Council of Canada, the NCAA, and any others?

5 A. Well, that NCAA and Sport Medicine Council are constitute really the bulk of the samples. We do occasionally receive small amounts of samples from power lifting associations, as well as body building, but this consitutes a small percentage of the total.

10 Q. All right. And then, of course, we have already indicated in our review of your CV, your laboratory did the testing for the Montreal Games of the Olympics in 1976, and the Lake Placid Games in 1980?

A. That is correct, yes.

15 Q. Now, I thought it might be useful at this juncture if we were to go to the subject of anabolic steroids. And you have been good enough to take a selection of overhead transparencies which will be, I think, of some assistance to you, Mr. Commissioner. It is
20 an overhead presentation that Mr. Proulx and I both saw a long time -- it seems like a long time ago now but it was --

THE COMMISSIONER: Is this what you were saying was over your head?

25 MR. ARMSTRONG: Actually, it is the

overheads that come a little later that really are over my head, but this may be as well.

So, what I am in effect going to do is just ask, if I may, that -- I don't know, if we turn down the lights I think for this, and we'll give you a mike, Professor Dugal, and you are ready to go.

Why don't you just start and I may interject as may the Commissioner from time to time, but what you are now going to do is --

THE COMMISSIONER: Will you turn the lights out now please, Mr. Registrar.

MR. ARMSTRONG: -- is talk about the nature of anabolic steroids.

THE COMMISSIONER: Thank you.

THE WITNESS: Okay. What I have attempted to do here is to try to summarize in the easiest manner possible the actions and side effects of anabolic steroids. And I thought that a better understanding might be provided by examining the actions of testosterone, which is a basic male hormone, at the time of puberty. I will try to make this simple without oversimplifying, of course, in order to give you, Mr. Commissioner, a broad overview --

THE COMMISSIONER: Thank you.

THE WITNESS: -- of what anabolic steroids

are, and also why they have side effects. I think that will become clear as we go on.

At the time of puberty, which occurs at different ages, of course, but usually between anywhere
5 between 10 and 14, the number of modifications that happen to a boy which slowly but surely transforms him into a man. There is an increase in thickness of the skin, a proliferation of sebaceous glands, which the infection thereof may give rise to acne. And finally, there is a
10 prominence of the veins under the skin.

Simultaneously -- some of these process are simultaneous, others are consecutive -- there is sexual maturation, enlargement of the testicles, growth and functionalization of the penis and scrotum, and finally,
15 appearance of pubic hair.

One of the most spectacular effects made by testosterone is, of course, growth promotion, and increase in height, which is again spectacular at the particular moment in life.

20 THE COMMISSIONER: This is the normal testosterone that one develops. Is that what are you talking about?

THE WITNESS: That is correct, sir.

THE COMMISSIONER: Thank you.

25 THE WITNESS: Development of the musculature

of long bones, a rapid increase in body weight, all these effects leading to an increase in physical vigor.

And finally, masculinizing effects which manifest themselves in growth of hair typical of the male, permanent deepening of the voice, due to enlargement of the larynx and growth of beard, which is an event that may lag behind the others. And for those whose inheritance so dictates, the first signs of eventual baldness.

THE COMMISSIONER: You don't have that problem.

THE WITNESS: No, not yet anyway.

And finally, growth stops due to the closure of the bone plates of long -- or the plates of long bones. Growth may continue a bit after this process, but in a much slower fashion.

So, essentially then, the male hormone -- and bear with me for a moment, Mr. Commissioner, I won't go too much into chemistry.

MR. ARMSTRONG:

Q. Can I just ask a question to interrupt. This process of puberty that you describe over this two-year period, is all of these masculizing effects that take place, is that because the body is now producing more testosterone? I take it each male is born with -- each

human being is born with testosterone and it is just that at a certain age you start to develop more of it, is that it?

5 A. That's right. Through a complex mechanism which is not fully understood or elucidated, at the time of puberty, there is a surge in the secretion of testosterone, which of course promotes all these effects. It's not the only hormone involved. It is a much more complex mechanism, but testosterone mediates most of these
10 effects.

 Q. Fine, thank you.

 A. So, all those effects can be summarized as being either androgenic or anabolic. The androgenic effect is, of course, the virilizing or masculinizing
15 effects. And the anabolic effects relate to the growth promoting properties of testosterone.

 It was thought a few years ago that these actions were mediated by different receptors in the muscle, but we now know that they are just expressions of
20 the same receptor hormone interaction, but in different tissues. Okay.

 And therefore about 40 years ago, the rationale for developing anabolic steroids were two-fold. The first one was to increase the anabolic effects.

25 THE COMMISSIONER: That's the growth

effects?

THE WITNESS: That's the growth effect.

THE COMMISSIONER: And to decrease the masculinizing?

5 THE WITNESS: And to decrease the masculinizing effect, which as you heard many times in this hearing room, are undesirable effects, especially --

10 THE COMMISSIONER: I am sorry. That the results, not the purpose of. I think you said that was the purpose of developing it.

THE WITNESS: That was the purpose of developing these substances, yes.

THE COMMISSIONER: To decrease the androgenic effects?

15 THE WITNESS: That's right. The androgenic effect being undesirable in women and children.

THE COMMISSIONER: I see.

THE WITNESS: The virilizing effects.

THE COMMISSIONER: I see.

20 THE WITNESS: Another rationale was to increase the efficiency of oral absorption by decreasing the biotransformation of testosterone in the liver. The up shot of all of this was again the development of several molecules, which again have the basic nucleus of
25 the male hormone, but which differ in some of their

chemical characteristics.

MR. ARMSTRONG:

5 Q. Can I just stop you there. You had a
slide a little earlier that showed these four rings, and
it is about five slides back.

A. Yes.

THE COMMISSIONER: One of the first ones
you had.

10 MR. ARMSTRONG:

Q. Can you just move it down? That
picture of those four rings, that is what you biochemists
or pharmacologists, that is how you draw testosterone?
15 That's what it looks like?

A. That's what it looks like on a piece of
paper, yes.

Q. All right. So, then the slide that you
just had there that you were going to show us, you are
20 going to show what has been done artificially or
synthetically to develop --

THE COMMISSSIONER: Different type of
steroids.

MR. ARMSTRONG:

Q. -- different kinds of steroids?

A. That's right.

Q. All right.

5 A. As you see, I will go to the next slide afterwards to make it clearer, but some modifications have been made at this level, for example, introducing --

THE COMMISSIONER: What does the OH stand for?

10 THE WITNESS: Hydroxy.

THE COMMISSIONER: Pardon?

THE WITNESS: Hydroxy. Oxygen and hydrogen.

THE COMMISSIONER: Thank you.

15 THE WITNESS: But essentially, groups have been introduced at that level in order to prevent the inactivation by deliver of this particular group. Inactivation -- well, transformation of the group here gives rise to inactive products. And introducing a
20 chemical group here protects that group from inactivation, essentially.

Other modifications have been made at this level; for example, withdrawing this group here has been purported to increase the anabolic effect and to decrease
25 the androgenic effect.

THE COMMISSIONER: You have several drawings in your next schedule here.

THE WITNESS: That is correct, sir.

Here we are. Again, the same basic nucleus but transformations at --

THE COMMISSIONER: Let's took at Dianabol which we have heard a lot about.

THE WITNESS: Yes.

THE COMMISSIONER: What are you showing us there? Dianabol is the fourth one down.

THE WITNESS: That's right. If you compare to the top structure, you will see two differences. The introduction of a CH₃ group in what is it is called the 17 Alpha position, and the introduction of a double bond in the nucleus. You see at the top structure, there is no such double bond.

Now, these two modifications make --

THE COMMISSIONER: What are the ingredients of Dianabol now? If I am going to make Dianabol, how do I do it?

THE WITNESS: You synthesize it from testosterone or some other molecule.

THE COMMISSIONER: You take testosterone as a base?

THE WITNESS: That's right. You might do

it that way.

THE COMMISSIONER: I am not planning on this experiment, but how would one go about manufacturing, say, Dianabol?

5 THE WITNESS: I am unfortunately not familiar with either the organic synthesize or manufacture of Dianabol. But, essentially, you can see a transformation of this molecule, between this one here is -- should be a fairly easy process.

10 THE COMMISSIONER: So, the one on the left-hand side, you got an extra line across the top of the first -- sort of first little cell. What does that mean?

THE WITNESS: You mean this here?

15 THE COMMISSIONER: That one there, yes?

THE WITNESS: That is a double bond. It is called a double bond in chemistry. It means that instead of having hydrogen sticking out, you have a double bond, which links those two atoms of carbons.

20 This is a symbol here of carbon atoms.

THE COMMISSIONER: What does the CH₂ mean on the right-hand side?

THE WITNESS: You mean this one here?
That's C₂H₅ or CH₂CH --

25 THE COMMISSIONER: No, I am on Dianabol. I

am sorry --

THE WITNESS: Dianabol is right here.

THE COMMISSIONER: Yes. What does CH2
mean?

5 THE WITNESS: It is CH3. It is not very
clear.

THE COMMISSIONER: I am sorry, it looks like
3, right.

THE WITNESS: Methyl. M-E-T-H-Y-L.

10 THE COMMISSIONER: Methyl; what is that?

THE WITNESS: That is a group, a chemical
group that can be substituted at this position to modify,
as I indicated, the structure, and modify the --
presumably modify the effect in a desirable sense.

15 THE COMMISSIONER: Then you have got a ratio
there, three to one. What does that mean? What is the
ratio?

THE WITNESS: Okay. That is a measurement
which is made in animals that may not be applicable to
20 man, but it's a ratio that means that this molecule is
presumed to be three times more anabolic than androgenic.

THE COMMISSIONER: I see.

THE WITNESS: Okay. the ratio of
testosterone, for example, is assumed as a baseline value
25 to be one to one.

THE COMMISSIONER: Even androgenic and even anabolic qualities; is that right?

THE WITNESS: Well, not necessarily. It's arbitrarily set at 1.1 --

5 THE COMMISSIONER: You measure against that?

THE WITNESS: That's right. It serves as a yardstick for the other measurements. But again this is --

10 THE COMMISSIONER: I think you had Stanozolol on there, too, didn't you. We just missed it.

THE WITNESS: Yes. We have Stanozolol over here, which again has two main modifications. This methyl group in the 17 position, and this extra nucleus here --

15 THE COMMISSIONER: I see it's got 6 to 1 ratio, which means it's a higher ratio of anabolic, is that right?

THE WITNESS: That's as measured in animals, yes. Again, it may not apply to man.

20 THE COMMISSIONER: This is animal --

THE WITNESS: Yes.

THE COMMISSIONER: -- statistics. Thank you.

MR. ARMSTRONG:

Q. Sorry, can you just put that back up and let's go to the natural testosterone at the top, so you -- so, you have got your ratio of anabolic to --

5 THE COMMISSIONER: Assumed to be one on one.

MR. ARMSTRONG:

10 Q. -- androgenic is one on one. So, the effect then, in each of these cases of manufacturing synthetic steroid or -- I don't know if I am using the proper terminology --

A. Yes.

15 Q. -- synthetic steroid is just as you indicated earlier; that is, to increase the anabolic effect in the case of, for example, Deca-durabolin to five times and the Maxibolin is 8 to 1 and so on?

A. That was the objective 30 or 40 years ago when the synthesis of these compounds were made.

20 THE COMMISSIONER: I see. All right.

THE WITNESS: It is very common in chemistry or pharmaceutical chemistry to modify the basic nucleus of a particular hormone in order to enhance certain effects and to decrease certain others.

25 THE COMMISSIONER: I understand.

MR. ARMSTRONG:

Q. I am sorry. Can I just ask you one other question? What was the ratio that resulted in the production of Stanozolol, 6 to 1?

5 THE COMMISSIONER: Six to one.

THE WITNESS: Six to one.

MR. ARMSTRONG:

Q. Dianabol is 3 to 1.

10 A. I insist again that these measurements are made in rats usually.

Q. All right.

15 A. Measuring the increase of certain muscle of the androgenic activity of certain muscles. It may or may not be applicable to man.

The practical conclusion of all this is that there is no androgenic anabolic steroid which is totally devoid of androgenic effects.

THE COMMISSIONER: I understand.

20 THE WITNESS: In other words, anabolic steroids are all --

THE COMMISSIONER: Androgenic.

THE WITNESS: -- to a certain extent androgenic.

25

MR. ARMSTRONG:

Q. Just before you run a way with that, one or more of the athletes who have testified, indeed, certainly I believe Miss Issajenko, talked from time to time about a particular anabolic steroid being milder than one of others. For example, she said that, I believe, that she found that Dianabol was milder than Winstrol, which would be Stanozolol. And do -- if she's using the layman's language of being milder, is she really saying what appears on this chart, that the anabolic ratio -- the anabolic androgenic ratio of Dianabol is 3 to 1 as compared to 6 to 1 with Stanozolol?

THE COMMISSIONER: Well, Dr. Dugal said that's only been tested on rats. Therefore, it is not a safe premise that it has the same effect on humans.

THE WITNESS: It is simply a test to measure that ratio. It doesn't mean much as far as athletes are concerned.

Certainly, the appreciation of mildness is a very subjective one. Some athletes would find Dianabol milder, but other female athletes have found on a subjective basis, self-appreciation of side effects, that Dianabol is indeed much stronger, a much stronger androgenic substance than the other steroids. So, we have not elucidated this particular problem in the sense that

it is highly subjective.

THE COMMISSIONER: All right. Thank you.

THE WITNESS: There is no systematic study.

5

MR. ARMSTRONG:

Q. Okay. Well, I will just ask one more question then, I will stay out of this for a moment, but you say Dianabol is much stronger than some other steroids. Do you mean it's stronger, for example, than Stanazolol?

10

A. No, I did not say that it was stronger.

THE COMMISSIONER: Some athletes have said that there --

THE WITNESS: Some athletes have said that -- female athletes, that Dianabol is stronger, if you wish, than Stanazolol. And there are other reports in the literature from anecdotal evidence to the contrary.

15

Again, I am just insisting that these side effects as reported by athletes are in most cases subjective, very subjective. There is no systematic study of real or apathic (phon) function or what have you to determine whether this or that substance is stronger or milder than the other.

20

25

MR. ARMSTRONG:

Q. Fine, thank you.

A. Again, I do not wish to bore you here with physiology, Mr. Commissioner, but I think this may be
5 useful as a reminder in order to explain to you the side effects of anabolic steroids.

Q. You might just pull that down a little so that we can get the benefit of the whole transparency.

THE COMMISSIONER: All right.

10 THE WITNESS: Okay. A gland called the Hypothalamus here through the mediation of a hormone called the gonadotrophin releasing hormone, stimulates the production of LH and FSH from the anterior pituitary. Those two, in turn, stimulate either the spermatogenesis,
15 the production of sperm or the production of testosterone.

Now, when the certain level of testosterone is reached in the blood, there is a feedback mechanism that goes directly to the Hypothalamus saying -- sending a signal to the testicles to stop producing testosterone.

20 So, the up shot of all this, very simply, is that if the body kind of senses that too much testosterone is being produced, a signal is sent to decrease the production.

THE COMMISSIONER: All right.

25 THE WITNESS: If there is too little

production of testosterone to maintain constant blood levels, a signal is sent to increase the level of testosterone. The up shot being that the blood concentration is fairly constant in time.

5 I have tried to summarize here what is known about adverse effects of steroids and is divided in males and females and those which are common to both sexes. Okay.

10 Before puberty, the appearance of acne has been noticed, reported. And there are, of course, disturbances of growth and sexual development because these molecules look very much like testosterone.

15 After puberty, once ultimate growth, if you wish, has been obtained, there are symptoms of familiarization, gynecomastia being fairly frequent, high-pitched voices a bit less frequent.

20 There is also the equivalent that some others have coined of chemical castration which implies testicular atrophy, suppression of sperm production, an increased libido in the first days or weeks of treatment or administration, but then which is followed by a significantly decreased libido.

25 Again, the appearance or aggravation of acne because of the effect of the the steroids on sebaceous glands. And finally, some prostatic and bladder

disorders.

THE COMMISSIONER: Well, that is not exhaustive, according to our studies. There are much more other side effects than that.

5 MR. ARMSTRONG: He is going to go on.
These are the ones just common to the males.

THE COMMISSIONER: I am sorry, just common to the males?

THE WITNESS: Just common to males.

10 MR. ARMSTRONG: And there are some others that are common to both.

THE COMMISSIONER: All right.

THE WITNESS: That again --

15 THE COMMISSIONER: Do you want to drop that down a bit. Females.

THE WITNESS: We pass on to the effects, adverse effects --

THE COMMISSIONER: The first ones were just males?

20 THE WITNESS: To males.

THE COMMISSIONER: All right. Thank you.

THE WITNESS: Specific to males.

THE COMMISSIONER: All right.

25 THE WITNESS: Those are specific to females.
Again in females, the body is literally --

THE COMMISSIONER: Masculinized?

THE WITNESS: Masculinized, because again these hormones are very similar to the male hormone. So, the body is reacting in the same way as if it was exposed to an excess of male hormones.

Those effects can be divided into either reversible or irreversible. And that, of course, is the general opinion at the present time, that acne, menstrual interruption, and shrinkage of the breast are largely reversible effects upon interruption of administration --

THE COMMISSIONER: Would that dependent on the extent of use or the time or is it always reversible?

THE WITNESS: It is apparently always reversible, at least from what is reported.

THE COMMISSIONER: All right.

THE WITNESS: Irreversible effects. Of course, you have heard about those before. Deepening of the voice.

THE COMMISSIONER: What is Hirsutism?

THE WITNESS: That is growth of hair in a pattern typical of the male: facial hair, moustache, so and on so forth.

THE COMMISSIONER: And baldness, too?

THE WITNESS: Baldness, of course, accompanies all of this. There is an enlargement of the

clitoris. And in the early days of pregnancy there might be masculinization of the fetus.

THE COMMISSIONER: Of the fetus.

5

MR. ARMSTRONG:

Q. I suppose, obviously, in a female fetus, if that's under the irreversible effects, that really in a way untold damage of a child?

10

A. There would be fetal harm, there would also be a child to be born might be -- might have some female and male sexual characteristics.

Q. I see.

15

A. And finally, the adverse effect which have been known to occur in both sexes. Liver function abnormalities, I believe you have heard --

THE COMMISSIONER: Yes.

THE WITNESS: -- abundantly about these.

THE COMMISSIONER: Cardiovascular has become of increased concern, I understand.

20

THE WITNESS: Yes, it is. There is numerous studies now coming out. Again, I have tried to be simplified here. The anabolic steroids increased fairly significantly what is called the bad cholesterol and increases the good cholesterol. The up shot being that athletes abusing these substances might be

25

predisposed to cardiac disease much earlier than they would be otherwise.

THE COMMISSIONER: Which may not show for sometime, but later on?

5 THE WITNESS: That is correct, there might be a lag period because --

THE COMMISSIONER: Most cardiovascular disease of that sort sometimes take a long time to crystalize?

10 THE WITNESS: That's correct. This might be an acceleration process depending on circumstances.

THE COMMISSIONER: Right.

THE WITNESS: Dose, frequency, and so on and so forth.

15 THE COMMISSIONER: Water and sodium retention?

20 THE WITNESS: That is well-known also. It was thought in the early days and still thought today that water and sodium retention is partly responsible for the gaining weight.

Muscle spasms do occur also. This has been reported in some studies to occur about between anywhere between 9 and 11 percent of patients.

25 THE COMMISSIONER: Psychological changes which we have heard about.

THE WITNESS: You have heard about also and they take different form and are largely dependent on the psychological background of the individual.

THE COMMISSIONER: That's very good, thank you.

THE WITNESS: And let me just show you, if you would like me to briefly, some quantitative data that are extracted from a recent study conducted in Finland where a number of biochemical parameters were measured in a number of athletes before and during self-administration of anabolic steroids.

THE COMMISSIONER: All right.

THE WITNESS: You can see here a significant decrease in the hormone that governs --

THE COMMISSIONER: Sorry, you have to explain that to me a little more. I don't know where we start. You start with the blue --

THE WITNESS: You start here which is baseline value, that is before administration. And other measurements were made two and three months after administration of anabolic steroids.

THE COMMISSIONER: It is what's going down?

THE WITNESS: Sorry, sir?

THE COMMISSIONER: What is going down?
What does that show?

THE WITNESS: The LH which I have shown
you in the previous overhead.

THE COMMISSIONER: Yes, I see.

THE WITNESS: This is the hormone that
5 governs testosterone production.

THE COMMISSIONER: That shows the decrease?

THE WITNESS: That shows a significant
decrease by about, ball park figure, a figure of 50
percent.

10 THE COMMISSIONER: All right, almost 50
percent.

THE WITNESS: I have got difficulties here
because my overheads are larger than the screen.

THE COMMISSIONER: That's fine.

15 THE WITNESS: Now, in the same individual,
again, the testosterone or serum testosterone was measured
again before administration, two and three months after
the administration, and some months after interruption of
treatment.

20 THE COMMISSIONER: All right.

THE WITNESS: Okay. Now, this here may lead
to misinterpretation in the sense that some of these
athletes, you remember there were 14 of them, about half
of them were also on testosterone.

25 THE COMMISSIONER: I see.

THE WITNESS: There is pooled data indicating that testosterone is increased, but that would be the sum of endogenous and exogenous testosterone.

THE COMMISSIONER: All right.

5 THE WITNESS: But you can see --

MR. ARMSTRONG:

Q. Just to interrupt you, to put another way, it is the sum of the natural testosterone in the body and that is taken by way of drug?

10 A. That is correct, in six or seven of these athletes out of 14, which explains this increase here. But the real effect is a constant decrease of secretion of the hormones to this level some months afterwards.

15 This, by the way, to get back to normal values again, may take as much as four to six months, again depending on length of treatment, dose, frequency of the dose, and so forth.

20 Again the measurement here --

THE COMMISSIONER: That's the sperm count.

25 THE WITNESS: -- of sperm count in eight subjects, a subset, in other words, of this athlete population, and again baseline value here before administration of steroids and --

THE COMMISSIONER: It is practically zero?

THE WITNESS: -- three months afterwards.

It is practically suppression, yes.

Finally, testicular volume, again shrinkage
5 of the testicles. Again, here baseline value before
administration and three months afterwards. The decrease
that is anywhere from between 20 and 25 percent after
three month's administration.

THE COMMISSIONER: Thank you.

10 THE WITNESS: And finally just to put a
picture to my words earlier about --

THE COMMISSIONER: Will you drop the top
down so we can see the writing.

THE WITNESS: Low density lipoprotein
15 cholesterol is the bad cholesterol that I showed before.

THE COMMISSIONER: Right.

THE WITNESS: And again you can see here
that before treatment, two and three months afterwards.

THE COMMISSIONER: Right.

20 THE WITNESS: That increase is
statistically significant, but it is not determined yet
whether it is clinically significant as you have pointed
out earlier.

THE COMMISSIONER: All right, thank you.

25 THE WITNESS: And again the high density

lipoprotein cholesterol, HDLC, the good cholesterol. Again baseline value before treatment, two and three months afterwards. It is decreased by almost 100 percent.

5 The combination of the increase and the bad cholesterol and decrease of good cholesterol may, I am just saying, may predispose young people taking anabolic steroids to premature heart disease.

THE COMMISSIONER: I understand.

10 THE WITNESS: Some adverse effects which are related to the practice of sport itself. What I have indicated earlier was mostly data taken from patients treated at normal doses, except the last few graphs I have showed you, which are from athletes, but it is generally believed that as you well know anabolic steroids increase
15 stamina and so on.

THE COMMISSIONER: And aggressiveness and could result in overtraining?

20 THE WITNESS: That's right. Which may lead to overtraining which in turn may lead to muscle and tendon injuries, rupture of tendons, and possibly degenerative disease of the joints. This has been reported in the European athletes about 10 years ago.

25 Steroid-induced polypharmacy, of course, you have heard abundantly about athletes who are on steroids tend to take more on the basis that if one pill is good,

three will be three times better. Or alternatively, to stack several steroids because they do believe or are made to believe that some steroids have properties that others haven't.

5

THE COMMISSIONER: I have an uncle like that. He thought one pill was all right, two was always better.

10

THE WITNESS: Yes. The swelling or water retention which is very often the consequence of anabolic steroids may lead to the use of diuretics, which in turn may lead to potassium supplementation, because there is a significant loss of potassium with the use of certain diuretics.

15

The attempt to restore testosterone levels may lead to the use and has led to the use of human chorionic gonadotropin, HCG, which increases testosterone production.

20

And finally, anti-oestrogens are apparently very popular in the bodybuilding field in order to prevent the femalization effect of the anabolic steroids. The major one, of course, being gynecomastia.

Creation of a clandestine climate. I don't think I have to assist you in that, you have been well briefed, I believe.

25

THE COMMISSIONER: We have heard of that.

THE WITNESS: And to end with this particular session, I have --

MR. ARMSTRONG:

5 Q. Can you just lower that done so we get the heading.

A. Sorry. I have tried here, Mr. Commissioner, to summarize what anabolic steroids have been used for and are used for, and what is generally
10 believed at the present time to be the efficacy and therapeutic benefits.

THE COMMISSIONER: Well, my discussion with the medical profession is that it is hardly used at all?

THE WITNESS: Pardon.

15 THE COMMISSIONER: My discussion with the medical field it is hardly used at all any more?

THE WITNESS: That's right.

THE COMMISSIONER: It is very seldomly used by any doctors.

20 MR. ARMSTRONG: That is going to be the result of this description of this slide.

THE WITNESS: I did not know you had been such informed, but this summarizes --

THE COMMISSIONER: It is hard to keep up
25 with you fellows.

THE WITNESS: Testosterone deficiency, of course, can be treated with these substances. It is now thought that protein or states in which muscle wasting have occurred, like extensive surgery and so forth, that their usefulness is for all intents and purposes nil.

5 Anemia, special cases of anemia, can be treated with steroids especially those due to bone marrow failure, but anemias of other origins are refractive to this kind of treatment. Inoperable carcinoma of the breast in

10 certain --

THE COMMISSIONER: We have heard about that.

THE WITNESS: Osteoporosis, the use is questionable.

15 And growth retardation. Steroids have been used in the growth retardation in children, but again their efficacy is both questionable and controversial because growth or bone maturation, if you wish, occurs faster than growth. So, the up shot of treating children

20 with these substances may be that their ultimate height might never be reached in spite of that attempt.

THE COMMISSIONER: I see.

THE WITNESS: And of course there is A-one therapeutic indication in which --

25 THE COMMISSIONER: What is that,

Angioneurotic Edema?

THE WITNESS: That is a complicated disease characterized by a lack of an enzyme inhibitor which causes clinical symptoms such as a edema of the
5 extremities, swelling of the extremities of the genitalia as well as the upper respiratory track. In conclusion --

MR. ARMSTRONG:

Q. Can I just -- are you going to do that?

10 Okay, sorry.

A. That is the general conclusion of all this. The present consensus is again that a 40-year research for a poor anabolic has been as for all intents and purposes has been a futile undertaking.

15 Q. By that you mean that every anabolic steroid or every steroid synthetically that's been produced still has certain androgenic characteristics?

A. That is correct. All of them, without exception.

20 The potential of serious side effects of those substances which are administered by mouth, like Stanozolol, Dianabol and so forth, precludes their treatment and their use in almost all circumstances with the possible exception of the condition I mentioned as
25 Hereditary Angioneurotic Edema.

THE COMMISSIONER: Right.

THE WITNESS: It is also believed now that when androgen therapy is indicated such as deficiency of the testicles in men, which is called male hypogonadism, that the treatment of choice is testosterone administered
5 in the form of longacting esthers intramuscularly. In other words, a shot of intramuscular testosterone every two or three weeks is the treatment of choice.

And finally, the only clear indications, with an "s", for androgen therapy outside of male
10 hypogonadism are the following: again, angioneurotic edema, selected patients with anemia due to bone marrow failure and inoperable cancer of the breast.

The long and short of this being that anabolic steroids have probably exhausted their
15 therapeutic usefulness.

THE COMMISSIONER: Thank you very much, Doctor.

MR. ARMSTRONG: Just before we recess, what I propose, Mr. Commissioner, is that we will have
20 this selection of slides that has been just been shown photocopied and then marked subsequently as an exhibit.

THE COMMISSIONER: All right. We will take a morning break.

--- Short recess.
25

--- Upon resuming.

THE COMMISSIONER: Mr. Armstrong.

MR. ARMSTRONG: Yes, thank you, Mr.
5 Commissioner.

Professor Dugal has prepared for us a series
of slides on the actual testing procedure that is used
currently by the IOC accredited labs to detect banned
substances as listed on the IOC list that we have filed,
10 and I think I will just do what I have already done is
just ask you, Professor Dugal, to take over and give us
your selection of overheads that will illustrate together
with your own commentary the testing procedure.

THE COMMISSIONER: Very good. Put the
15 lights down, please.

Very well, Dr. Dugal.

THE WITNESS: This again, Mr. Commissioner,
will be an overview of what is being done and again
explained in --

THE COMMISSIONER: Is your mike on, your
20 little mike there?

THE WITNESS: I don't know. Is it on?

MR. ARMSTRONG: Yes, it is.

THE COMMISSIONER: I am not sure. Make
25 sure it is. Make sure it is on down there.

MR. ARMSTRONG: No, it is on.

THE COMMISSIONER: All right.

THE WITNESS: Again, as an introduction, you
know by now that the process of drug testing involves
5 first urine collection under secure conditions and so
forth. I believe that Dr. Pipe earlier in the Inquiry
explained this to you so I won't deal with it.

The continuity problems I think have been
dealt with also. I will deal, therefore, with the
10 techniques used for analysis, and try to be as graphic as
possible in my explanations. And I may or may not, that
will be from Mr. Armstrong to decide, deal with the B
sample.

THE COMMISSIONER: All right.

THE WITNESS: Again, just to summarize very
15 briefly as an introduction what happens to athlete's
samples once they are received in the lab, there is an
inspection of the seals, of course, to ensure that they
are valid. There is a secure image -- secure storage of
20 the B samples for eventual counter expertise.

The sample or samples are assigned a lab
code number by which the sample will then become known in
the lab. Measurement of pH and specific gravity, and I
will come back on this immediately after this overhead of
25 why it is done.

And, of course, there is a recording of the physical criterial characteristics of the samples.

They are then separated. The samples are separated to several aliquots. That means a few
5 millimetres into each tube, which are then extracted -- and I will come back on this eventually -- and submitted to each of the procedure. In other words, the analysis is not a single test. It is -- it can be as many as eight different analyses which are targeted to specific classes
10 of drugs.

In other words, anabolic steroids are not tested for in the same manner as psychomotor stimulants are for example.

We then go down to instrumental analysis,
15 which is essentially a screening process. What we are attempting to do at this stage is to determine whether a substance is present or not. In other words, this gives -- the screening process gives us very useful information, but it is by no means a final determination
20 of identity.

Once that is effected, the sample is considered as either positive or negative. If it is negative in all procedures, of course, no further action is taken. And if it is positive, then a number of
25 identification procedures, which I will attempt to

describe for you as well, are initiated.

And finally, the reporting is done to the appropriate body.

5 Why is pH measured? And this again is a simplification of what happens in the kidney. Most drugs are either acidic or basic in nature. Amphetamine, for example, is a basic substance. And aspirin is an acid or acidic substance. And they will behave, as far as their kidney or renal excretion is concerned, in different
10 manners.

If the urine is maintained acidic, for example, by the administration of for example, ascorbic acid, acids such as aspirin and others are going to be excreted from blood into urine across the renal pituitary
15 membranes, but are likely to be reabsorbed in the blood. So, that their excretion is slowed down if the urine is acidic.

Conversely, those same acids, if the urine is maintained alkaline by administration, for example, of
20 sodium bicarbonate, will be excreted without being absorbed because the body is just not equipped to absorb or to reabsorb --

THE COMMISSIONER: The alkaline.

THE WITNESS: --molecules which are charged
25 here.

As far as bases are concerned, well the converse is true. Bases, such as amphetamine, into acidic urine will take an ionized or so-called ionized form such that reabsorption will not occur and excretion will
5 happen. Conversely, bases in an alkaline medium will be maintained into what is called a molecular form and be reabsorbed across the epithelial membrane into the blood.

Now, a picture again being worth a thousand words, this is what happens for example to the excretion
10 of amphetamine as a function of time under different pH conditions of urine. And this links with the previous overhead. You can see here -- and this is extracted, by the way, from the work of Professor Beckett back in 1966. Under normal fluctuating pH conditions, normal diet,
15 amphetamine is excreted, as you see, as a function of time in this matter.

If the urine is maintained acidic, excretion is considerably accelerated. And conversely, if the urine is maintained alkaline, the excretion is slowed down. In
20 other words, reabsorption into the body occurs continuously if the urine is maintained alkaline.

And this is important for our purposes, at least for stimulants, in the sense that if we do receive at the lab a sample which is highly alkaline, it means
25 that possible manipulation by alkalization of urine

might have taken place. And, therefore, that sample would be submitted special strategies.

THE COMMISSIONER: I see.

5 THE WITNESS: Okay. Likewise for specific gravity which is an index of the dilution or concentration of urine. If the specific gravity is very high, then normal procedures would apply. If conversely the specific gravity is low, then the sample will be treated differently.

10 In other words, larger volumes might be extracted, and so on and so forth. So, the treatment of the sample is submitted really to the value of the pH and the value of the specific gravity.

15 THE COMMISSIONER: Does that relate to whether it is diluted or not? We have had some evidence of some tests where the result is diluted?

THE WITNESS: That's quite correct.

20 Dilution refers in this particular case to either one of two realities. The first one being a real dilution through the use of diuretics or otherwise, which resulted in the low specific gravity, near that of water, if you wish, water being assigned a value of one. So, a value 1.005, for example, of a urine sample would be diagnosed as a very low specific gravity and would --

25 THE COMMISSIONER: So, when it is diluted,

it is either as a result of some diuretic? Would that result in diluted urine?

THE WITNESS: Yes, it would.

THE COMMISSIONER: Or just drink an awful
5 lot of water or beer?

THE WITNESS: Drinking an awful lot of fluids, of course, would also dilute the urine.

THE COMMISSIONER: If it is diluted, you can't make these tests; is that right.

10 THE WITNESS: You can, but it takes a little more effort, if you wish. It needs special strategies.

THE COMMISSIONER: I see. Because in Montreal we learned of four cases where the first test
15 came back too diluted to test. That was done in your lab I suspect. These are the weightlifters?

THE WITNESS: That is correct. In two of these cases, as I recall, the specific gravities were very low. And in two other cases --

20 THE COMMISSIONER: I think you reported four were too diluted tests, and they had to be retested in the Vancouver.

THE WITNESS: That is correct.

Those special circumstances provoked my
25 personal intervention to the SMCC in order to have these

athletes retested.

THE COMMISSIONER: Tested in Vancouver.

THE WITNESS: That's right. And you know what happened to that.

5 THE COMMISSIONER: I do indeed. We heard about it, it seems like a long time ago I heard all of that, but it was only in January.

10 THE WITNESS: I will now attempt to carry you through the main three processes involved in the analysis. And they are namely the extraction. Extraction is much like extracting iron from iron ore, for example. It is an attempt at purification.

15 Screening, which is determining whether a substance or substances is or are present in the sample. And then identification procedures which, are the last analysis made in order to determine the exact identity of a particular compound or compounds.

20 The process in a simplified manner is the following: Urine is transferred or aliquoted into a tube, if you wish, and urine, as you know, contain a lot of material that is symbolized by X, and D symbolizes the drug and/or its metabolites.

25 Very simply again, an organic solvent is added, a solvent which is admissible with urine or water, and then this two-phase solution, if you wish, not quite a

5 solution, but two-phase system, is shaken during a certain amount of time. And after this is terminated the drug has been extracted, and most of it has been extracted into the organic solvent, along with some natural compounds which are call co-extractable material.

10 That layer of organic solvent is transferred into another tube and the urine here is rejected because at this point it is useless. Concentrated eventually into a smaller volume in order to help or assist into the instrumental analysis and then subjected to analysis by gas chromatography and/or mass spectrometry.

15 Again, this process has four objective: The extraction of the D component in a complex biological matrix into an extract that can be handled by the instruments. It is a purification process.

I will now go on to screening procedures. And let me give you the technique of gas chromatography as an example.

20 Gas chromatography was developed in the late 1940s, but has known since then is quite a number of advances, both in computer acquisition and column technology, but let me just give you here, Mr. Commissioner, the principles of all this.

THE COMMISSIONER: All right.

25 THE WITNESS: Once the urine sample has been

extracted and purified, as we saw in the previous
overhead, the sample is introduced into this inlet called
an injection port with a syringe. That inlet is
maintained at a very high temperatures, like 325, 350
5 degrees Centigrade such that the material is instantly
vaporized. It's transformed from the liquid state to the
vapour state.

A gas is simultaneously fed to the injection
port and carries the vaporized material in this column.

10 Now, according to the physical chemical
properties --

THE COMMISSIONER: Is it all vapour now
once it gets into the column and oven?

THE WITNESS: Yes.

15 THE COMMISSIONER: It's vapour now?

THE WITNESS: Yes. That oven is
maintained -- either one of two things. That oven may be
maintained at a constant temperature, or it can be
programed at so many degrees Centigrade of increase per
20 minute.

The up shot here is that according to the
column material that is used, according to the temperature
at which this column is maintained or programmed and
according to the physical chemical properties of the
material that is injected, separation as a function of
25

time will occur. It's much like a race horse or a race -- horse race, rather, excuse me, where all horses start at the same level, but as the time goes by the distance from each other, it emerge at the gate. This is a similar
5 process where those molecules come in at a detector, the signal there is transformed via various means and give rise to peaks on the recording system.

THE COMMISSIONER: I see.

THE WITNESS: And this thing here is called,
10 appropriately enough, a chromatogram. It is the result of a gas chromatographic analysis. And the process can be summarized as follows: Again, you have a cluster -- let's assume we have got three components in this extract that we were dealing with. As a function of time, these
15 components will be slowly separated and emerge eventually. As you can see here, this is an example, after two minutes they are fairly well separated from each other and will eventually give rise to a signal at the very end. That signal, of course, being recorded on an integrater or
20 other electronic device.

THE COMMISSIONER: Okay.

THE WITNESS: Okay. The up shot again graphically for those three components that I mentioned is that the sample again is introduced. The solvent will
25 give rise to a peak, although today we have detectors in

doping control that for all intents and purposes abolish the solvent peaks so that this is a straight line.' And then we have emergence of these three peaks: the retention time, being the time at which the sample -- the component emerges relative to the time at which it was injected.

Under most circumstances where the -- when the operational parameters are maintained constant by appropriate selection, these retention times here will be reproducible such that the emergence of a compound, a drug, for example, a doping agent in one of these procedures, will immediately be detectable. In other words, the screening gives a first indication --

THE COMMISSIONER: Because of the peaks?

THE WITNESS: That's right, and the retention time.

THE COMMISSIONER: All right.

THE WITNESS: Okay. It is a preliminary indication of the identity of the drug or drugs which might be present in this sample. You can have good chromatography. In other words, peaks, that are elongated and fairly thin. And if you are not careful enough, you can have bad chromatography with peaks like this, a condition called tailing. But that's -- we don't go into too much detail. The important thing is that this device,

the gas chromatograph, separates different compounds as a function of time.

Then if we take a real sample -- assume a sample that doesn't contain any drug from an athlete, treated in procedure one which is the simplest extraction and chromatographic scheme, actually developed by my colleague, Donike, almost 20 years ago now and still in use, slightly modified by us later, however.

You can see here that this is a signal that originates from the injection into the gas chromatograph, solvent peak, if you wish. And then you have a straight line with only the internal standard here which is something which is added to the urine sample to control extraction efficiency as well instrumental analysis parameters.

THE COMMISSIONER: That's added for the testing procedure?

THE WITNESS: That's correct. It is not a drug, it is just a substance which is used for --

THE COMMISSIONER: It shows there?

THE WITNESS: Yes. For example if this were, and it is, the normal expected height and area of that peak, if we were under certain circumstances to have only half of it, we would be able to immediately diagnose the problem. So, this is an internal quality control

system for each sample and each type of analysis.

THE COMMISSIONER: I understand.

THE WITNESS: Okay.

5

MR. ARMSTRONG:

Q. Could I just ask you a question there?

10

When you are carrying out your tests at the Montreal lab, do you ever use the drug that you are testing for as an internal standard? For example, if you are testing for Stanazolol or Dianabol, are Dianabol or Stanazolol are they ever used as an internal standard by you?

15

A. No. We have developed our procedures by using an internal standard which is not an anabolic steroid. Other scientists in other labs may choose to use an anabolic steroid which might not be -- as an internal standard -- which might not be extracted in one of the two fractions. It is a possibility. But in Montreal we don't -- we have chosen not to do that.

20

Q. Why have you chosen not to do that?

A. Just a preference. It is a question of tradition in research and testing that we chose again as a strategy not to use. We prefer not to put -- not to use a drug as an internal standard for those procedures.

25

Q. And I take it that's so that there is just no chance that you confuse the internal standard with

what might be in the athlete's urine?

A. You know, even though some labs prefer again by choice or for reasons of tradition to use a particular drug like Stanozolol as an internal standard, doesn't contaminate in any way the sample in the sense that repeat analysis of a potential positive would be made without that particular internal standard. And that solves the particular problem.

Q. All right. Thank you.

THE COMMISSIONER: Okay.

THE WITNESS: Just to illustrate the fact that we can diagnose smokers as well as coffee drinkers in this particular procedure --

THE COMMISSIONER: What point are you trying to make.

THE WITNESS: It serves -- especially in the statistics for nicotine we are able to determine that less than five percent of athletes are smoking. But then to illustrate the fact --

THE COMMISSIONER: 9.45 caffeine, how many cups would that be?

THE WITNESS: 9.45, sir, is the retention time -- that's the time at which caffeine emerges in the system.

THE COMMISSIONER: Right.

THE WITNESS: This would be a fairly small concentration of coffee resulting from normal dietary intake.

THE COMMISSIONER: That means retention
5 time is 9.45 seconds, or what is that?

THE WITNESS: That's 9.45 minutes.

THE COMMISSIONER: Minutes?

THE WITNESS: Yes. So, you can see again
10 that separation of different compounds is effected quite nicely by this particular system.

Again, another example to show you a positive to methamphetamine.

THE COMMISSIONER: Let's see that.

THE WITNESS: Here we have methamphetamine
15 emerging, which is a parent drug. Amphetemine, it's metabolite and nicotine and caffeine.

Now, a picture like this immediately tells
us, even if the names are not appearing here, immediately
tells the technical people that there is something
20 suspicious about this sample and that probably methamphetamine and amphetemine are present but you need further analysis to find that.

THE COMMISSIONER: That's not decisive at
the moment?

THE WITNESS: No, that's not decisve. This
25

is strictly screening. It tells you effectively that there is something present.

THE COMMISSIONER: There is a problem there.

5 THE WITNESS: That methamphetamine and amphetamine are probably present, but you are not certain at this stage.

THE COMMISSIONER: All right. Okay.

10 THE WITNESS: And this is something that we come across quite often because athletes of course take all kind of medications including cough syrups and cough mixtures and so forth. You can see here again a picture of pseudoephedrine, a drug which is banned by the IOC, but then accompanied by Doxylamine which is an antihistamine
15 drug, and Dextromethorphan and its metabolite which is an antitussive.

THE COMMISSIONER: That's cough syrup?

THE WITNESS: This tells us --

20 THE COMMISSIONER: That would be cough medicine?

THE WITNESS: That's right. This is a typical chromatogram resulting from the recent administration of a cough mixture.

THE COMMISSIONER: All right.

25 THE WITNESS: And again you can see a good

separation.

Now, that's one procedure, let me show you the others.

We have dealt so far only with procedure one, but essentially the same basic principles that I explained to you apply for all the others. In other words, each urine sample is submitted to one procedure which has been devised for the specific purpose of detecting, for example, stimulants, narcotics, beta-blocking agents, steroids, and so forth. But because of the physical chemistry of all this, it is possible for some drugs to be detected in more than one procedure.

For example, stimulants, most of them, may be detected normally by procedure one, but also by procedure two which is a completely different one. The end result being that even at the screening stage you can get -- for example, for these drugs, in procedure one, a tracing such as this one. And in procedure two, a similar tracing but with very different retention times. Okay.

And again, combining these two pictures tells us immediately without even having recourse yet to identification that we are pretty sure that these compounds are present but remain to be confirmed. It is a nice way, in other words, to simultaneously confirm the presence of these drugs by two different procedures.

MR. ARMSTRONG:

Q. Could I just ask you here, you have in effect got eight procedures because you have got two procedures for anabolic steroids on that second last
5 overhead. And do I take it that in track and field or athletics that you would run each of those eight procedures on a urine sample of say somebody in the 100 meters who was selected to -- for doping control?

A. That is correct, yes.

10 Q. And does that involve then taking eight different extracts and running each of those eight extracts through each of the eight procedures?

A. That is correct, yes.

Q. All right.

15 A. In some instances or some sports, beta-blocking agents, for example, may not be tested because they would not be useful in those sports. Beta-blocking agents, as you well know, are useful in shooters to steady aim.

20 THE COMMISSIONER: Beta-blockers?

THE WITNESS: Pardon?

THE COMMISSIONER: Beta-blockers?

THE WITNESS: Yes, beta-blocking agents
here.

25 THE COMMISSIONER: Well, you wouldn't use

that in a 100-meter sprint?

THE WITNESS: No, you wouldn't, sir. And you wouldn't use them in the marathon either.

THE COMMISSIONER: Right.

5 THE WITNESS: So, again, sometimes there is a selective testing for some sports.

THE COMMISSIONER: All right.

10 THE WITNESS: But mostly stimulants, anabolic steroids, and so on and so forth, are usually tested for all athletes.

MR. ARMSTRONG:

15 Q. Just hold it one moment. I don't know whether you are going to cover this later or whether by asking you this I may be asking you to get to a level of detail that will not be particularly helpful, but we'll ask it.

20 Procedure four for anabolic steroids, you have something called free anabolic steroids and something called conjugated anabolic steroids and what does that mean?

A. That means that steroids are excreted first either as a parent compound and/or metabolites.

Q. Yes.

25 A. That parent and/or metabolites may be

conjugated to naturally occurring compounds in order to render them more easily handled by the kidney for the purposes of elimination, but other steroids may be eliminated as a free --

5

THE COMMISSIONER: Well, there are two different tests there? Mr. Armstrong said there is eight tests there, I see seven. Should we call -- number four should be two?

10

THE WITNESS: This, for further of clarity, sir, I have eliminated the eighth procedure which is for human chorionic gonadotropin.

THE COMMISSIONER: It is not shown there?

THE WITNESS: It is not shown here.

15

MR. ARMSTRONG:

Q. Well, the Commissioner is right, I had mislead the Commissioner because I thought that four was really two separate procedures, that is for the free and the conjugated.

20

A. They can be two separate procedures in terms of instrumental analysis. There is two ways to go about it. Some labs will process the free and conjugated fractions separately by instrumental analysis. Others may choose to pool the two fractions. It is much like going from Montreal to Paris but by two different planes, by Air

25

France or Air Canada. You get there almost at the same time but by different carriers. But the end result, so far as detection, is the same.

MR. ARMSTRONG: Thank you.

5 THE WITNESS: So, finally, to summarize, we have dealt, Mr. Commissioner, with chromatographic separation, separation of different compounds in the same sample, this combined to reproducible retention times. In other words, instrumental reproducibility, plus the cross
10 over in certain screening procedures that I illustrated between procedure one and procedure two, plus the use of selective detector element in this case providing preliminary identification of many compounds and are used to define further analytical strategics -- strategies,
15 excuse me.

THE COMMISSIONER: I understand.

THE WITNESS: And that essentially summarizes the --

THE COMMISSIONER: Screening process.

20 THE WITNESS: -- screening process.

It is a process by which we are essentially trying to determine whether a drug is present or not. If it is not, no further action is taken. If there is something or something is detected through these
25 procedures, then mass spectrometry or the identification

procedures come in.

THE COMMISSIONER: All right.

MR. ARMSTRONG:

5

Q. Just before you go on to mass spectrometry, what you have indicated here is that, I believe, that the gas chromatography technique is used as a screening technique to indicate the probable presence, if I can put it that way, of certain drugs.

10

Now, is gas chromatography ever used as the final determination of the presence of any of these substances?

15

A. Not in doping control. It is used in other areas of drug testing, although less and less as the final tool for identification now that mass spectrometry is much more affordable than it used to be. But in drug testing or in athletes in doping control, mass spectrometry has been mandatory, absolutely mandatory, ever since 1970 or '71.

20

In other words, at each Olympic Games, if I am to give this example, since Munich in 1972, the final tool for identification has always been gas chromatography combined to mass spectrometry. The gas chromatograph or other types of chromatography being used strictly as detection devices.

25

MR. ARMSTRONG: Fine, thank you.

THE WITNESS: Again, just as a reminder, Mr. Commissioner, we have received a sample, we have gone through the procedures, we have potentially positive results, we now go to gas chromatography and mass spectrometry.

THE COMMISSIONER: All right.

THE WITNESS: All analogies have their faults, as you know they are not perfect, but I am going to go through this one first and then come back to it, perhaps at the very end of my explanations.

Try to imagine this as sling shot, a rock and and Chinese vase. Assume that the Chinese vase is the drug, the molecule that we are looking for, that the sling shot is a filament -- I will come back to that -- the filament that produces energy, and that the rock is an electronic beam.

On impact, the vase is shattered. Okay. You pick up the pieces carefully -- each of these pieces have a different weight and a different shape, and if you carefully collect them together and glue them back you can reconstitute the Chinese vase in its original form.

This is essentially what mass spectrometry does. I will show this to you briefly. It destroys the molecule. It gives rise to a number of fragments, each of

that molecule, each one of them having a weight. And through careful analysis of this spectrum which is obtained --

THE COMMISSIONER: You put it back
5 together.

THE WITNESS: -- you can reconstruct the molecule itself.

Now, mass spectrometry is a very reproducible tool, and this analogy, as I told you, has
10 some defects in the sense that when you destroy many Chinese vases looking alike, you might not obtain always the same fragments, but in mass spectrometry you do. The vase or the molecule always breaks in the same manner if the operational parameters are maintained in a constant
15 fashion.

Okay. Let's deal briefly now with a combination of gas chromatography and mass spectrometry. Okay. We have dealt, as you recall, with gas
20 chromatography as a separation technique. And we will deal here with mass spectrometry as a detection and identification technique.

So again, the reminder that the compound or compounds are separated in a chromatograph and enter into the mass spectrometer, which at this point serves as a
25 detector, a very sophisticated detector.

The compound or compounds are ionized in the mass spec source. The ionization being, of course, the breakage of the vase. Okay. The molecule is broken down here into several fragments which are then -- which then
5 travel through a number of slits into a mass analyzer. And ionization can be pictured in this fashion.

Again you have got the intact molecule of the vase. Upon impact of the electron beam, the molecule is activated or energized, then breaks down into a number
10 of typical fragments. Okay. And this process is repeated again. And that process under specific operational conditions always gives rise to the same fragments.

THE COMMISSIONER: All right.

THE WITNESS: Okay. Or fragments -- the
15 number of fragments of the same abundance and the same weight.

And finally, after being filtered, the fragments -- they are called ions now, this molecule is now broken down, it has been mass analyzed, the fragments
20 are collected here, amplified, or their current -- electrical current is amplified and recorded through a computer.

And if you have two drugs, for example, which have been separated, each of one will give rise to
25 what is called a mass spectrum, which is a recording or a

graph of each of these masses with the corresponding intensity.

THE COMMISSIONER: It's the peaks, I guess, which are significant; is that right?

5 THE WITNESS: That's right. It is the peaks. Each of these lines --

THE COMMISSIONER: Yes.

THE WITNESS: -- is significant. The relative abundance of them is significant and the spectrum is also significant. You can see -- again, this is very
10 simplified, but for two similar drugs will give rise to significantly different mass spectra.

THE COMMISSIONER: All right.

THE WITNESS: With very few well-known
15 exceptions this is the case. And this serves as a final identification tool.

You can do either one of several things here. When you obtain a mass spectrum like this, you can interpret the data and come up with a molecular structure.
20 You can compare this spectrum to a spectrum that has been stored into a computer library to obtain a relative match, a hand and a glove, in other words, or you can compare it simultaneously to a standard, authentic reference material which you have in your laboratory.

25 THE COMMISSIONER: Now, I gather each drug

has its own spectrum; is that right?

THE WITNESS: That is correct, sir, yes.

We will come back to that with a specific example in a few moments.

5 Again to summarize, we have a mixture of compounds here, which are a mixture which is unresolved. Chromatography, either a gas or a liquid or what have you, separates the components as a function of time. And the mass spectrometer records each of these peaks, after a
10 mass spectrum has been produced, such that you obtain again typical finger prints of each of these drugs.

MR. ARMSTRONG:

 Q. Could I just ask you one further
15 question at this point? You mentioned a moment ago that there are certain well-known exceptions to the rule or principle that each compound has its own particular spectrum or spectra, and what are those exceptions? Are they any of the drugs that concern us on the -- or any of
20 the banned substances that concern us on the list?

 A. Certainly not anabolic steroids. Memory fails me here, but substances like ephedrine and pseudoephedrine, for example, which are just the same molecule but spatial arrangement, a bit different, gives
25 rise, if I recall, to the same mass spectrum, or just

about the same mass spectrum with slight differences though. But since they can be separated as a function of time, that difference is immaterial because pseudoephedrine can be separate from ephedrine --

5

THE COMMISSIONER: I am sorry, I don't follow you. In other words you can still detect the difference by further times; is that what you are saying?

10

THE WITNESS: That's right, by a difference in time. For example, ephedrine might -- assume for the same sake of discussion, that ephedrine and pseudoephedrine give rise to the same mass spectrum. We would still be able to differentiate between both by their retention times because they are very well separated one from each other in certain systems.

15

THE COMMISSIONER: I think Mr. Armstrong -- you said there were exceptions to the rule. In other words, there is some case where you cannot detect whether it was drug A or drug B, even though you know it is a drug?

20

THE WITNESS: No, I was just mentioning that fact into very general terms what the possible exceptions do not apply to drug testing in athletes, I was talking about chemistry in general.

THE COMMISSIONER: I see.

25

THE WITNESS: Okay.

MR. ARMSTRONG:

Q. Well, going to ephedrine and pseudoephedrine, I take it are both of those on the banned list?

5 A. Yes, they are.

Q. All right.

THE COMMISSIONER: But you say you could distinguish those?

THE WITNESS: Yes, of course we can.

10 THE COMMISSIONER: By the separation?

THE WITNESS: Without any difficulty.

MR. ARMSTRONG:

15 Q. Maybe I just haven't understood it, and it doesn't matter I guess, but I thought what you had told us earlier was that through this separation technique that you use all you do is get an indication of the presence of the drug, it is really the mass spectrometry that confirms that it is drug A or drug B; isn't it?

20 A. Okay.

Q. And so if they are separated in time on the gas chromatograph, that's just an indication of either ephedrine or pseudoephedrine, but if the mass spectrum of each is the same, you can't make a final determination if they are exactly the same?

25

A. Yes, you may.

Q. How?

A. What we were talking about before I started talking about mass spectrometry is only this process here, separation, okay, strictly. When you link the mass spectrometer to the chromatograph, you would obtain then mass spectra.

Q. Yes.

A. Okay. Now, again, suppose that A and B are respectively pseudoephedrine and ephedrine. They would be separated as a function every time, and their respective mass spectrum in this particular method would then be recorded.

So, you can make the differences. And their spectra is slightly different by the way, but you can have further statagies to identify those by making derivatives or further work up of that sample, or comparing their relative retention times to the standard, or comparing the their retention times and mass spectra to an authentic reference material.

MR. ARMSTRONG: Thank you.

THE WITNESS: But my point as far as drug testing was irrelevant to the differences -- to the well-known differences in mass spectrometry.

Again, you do recall, Mr. Commissioner, that

we had -- in chromatography we had separation and we had for each compound a single signal, just one signal.

In mass spectrometry, we add another dimension to this in the sense that a lot of information here, which is quite useful for identification, is generated. In other words, we don't have a three-dimensional device now, we have three dimensional or even multi-dimensional instrument which gives us a lot more information than the screening procedure. Okay.

In other words, the identity of that peak is decomposed into a mass spectrum which provides a lot more information.

And again, this may be important for what is to come today and tomorrow. These instruments have several capabilities, they can do a lot of things. They can take a full mass spectrum, in other words the full vase, or you can, through the computer, focus their detection on to very specific fragments, or what we would call the most specific fragments of that vase.

For example, that fragment here might be a small fragment of that vase, but a larger fragment would be -- with more Chinese painting on it, might be more significant for identity purposes. And so, you may -- this is called SIM, selected ion monitoring, or selected fragment monitoring, where you choose -- on the basis of

good science -- choose certain ions which you wish to monitor as a function of time. It is the basic principle by which anabolic steroid detection is effected for example. And we can see some examples of that later on.

5 So, again, we select discrete fragments here.

That, sir, summarizes the little introduction to mass spectrometry. I left it purposely simple but it is -- I hope it is useful to you.

10 THE COMMISSIONER: The last diagram you had three arrows pointing and three lines, is that -- there was a particular significance to that, I gather, was there.

THE WITNESS: It will become clear to you as we go along.

15 THE COMMISSIONER: I see.

THE WITNESS: This is a full mass spectrum.

THE COMMISSIONER: Of what, one sample?

THE WITNESS: Of the chinese vase that is broken. Let me get back to the vase.

20 THE COMMISSIONER: Well, I think you explained it. One would be sort of one with the particular painting part of it?

THE WITNESS: That's right. There we are.

THE COMMISSIONER: All right.

25 THE WITNESS: Okay.

THE COMMISSIONER: So, the arrow would point maybe to one particular part of the vase?

THE WITNESS: That's right.

Any analogy, again, has its imperfection,
5 but this fragment here, which presumably originates from the white part of the vase, may not be very significant.

On other hand, this fragment here and this one which has a handle, and this is the bottom of the vase, has some pointing on it, and so on and so forth,
10 would be more significant for our purposes. So, you may choose in this particular technique to monitor or to follow --

THE COMMISSIONER: It is a more distinguishing characteristic that you are looking for?

15 THE WITNESS: Exactly, precisely. And that's exactly what I wanted to illustrate by this is that you may choose to select a number of fragments of anabolic steroids, for example, which are much more significant --

THE COMMISSIONER: Than other fragments.

20 THE WITNESS: -- than others.

THE COMMISSIONER: Thank you. I understand now. Thank you. Mr. Armstrong has a question.

MR. ARMSTRONG:

25 Q. Now, this technique that you have just

described, I take it that is the technique that is used in your laboratory and all of the IOC accredited laboratories for testing the urine samples of athletes from various -- in the case of the IOC, various IOC, IAAF, what have you, meetings?

A. It is required procedure in all IOC accredited labs and for all testing of athletes. There are no certificate of analysis of a positive results is issued without this kind of analysis having been performed. It is absolutely essential.

Q. Now, is that procedure that you have just outlined in the last four or so, is that the identical procedure that's used to determine the presence of each one of the banned substances on the banned list? And is it used for anabolic steroids, ephedrine, stimulants, narcotics, et cetera?

A. It is used for all these drugs without exception. Additionally, it is used for the screening of anabolic steroids.

Q. All right. Now, explain that to me, if you would. Can you do that just before lunch.

THE COMMISSIONER: Go ahead.

THE WITNESS: I will try to do that, yes. Okay. I didn't want to show this to you, but I guess I will have to to answer Mr. Armstrong's question. Okay.

We have dealt with essentially so far with what is being done in the extraction, screening, and identification of psychomotor stimulants.

5 The same principles would apply to the others, except anabolic steroids, and the ratio of testosterone to epitestosterone. My meaning here is that for these compounds, as well as for diuretics, the screening is effected by chromatography and the identification is effected by gas chromatography, mass
10 spectrometry. It is a logical sequence of events of extraction, screening and confirmation. Okay.

THE COMMISSIONER: All right.

THE WITNESS: For steroids, we cannot use chromatography only.

15 THE COMMISSIONER: For masking? For selection.

THE WITNESS: That's right. And that's what I was coming to. For anabolic steroids the screening process is effected by -- that means high resolution, HR,
20 high resolution GC-MS, gas chromatography and mass spectrometry. And likewise confirmation is made also by GC-MS.

25 Let me give you a little bit of a historical background on this. In 1974, Professor Brooks, who you have met in --

THE COMMISSIONER: In London, right.

THE WITNESS: -- London, developed an RIA procedure that was directed at some functional groups of anabolic steroids, the object being that this RIA procedure, radioimmunoassay, would be able to detect a number of anabolic steroids.

THE COMMISSIONER: Well, just bring us up to date. So, the screening process you showed earlier this morning would not be a screening process for anabolic steroids.

THE WITNESS: No -- part of it would be. We use the gas chromatography to separate.

THE COMMISSIONER: Yes.

THE WITNESS: And the mass spectrometry is used here as a detector, a very sophisticated, sensitive detector.

THE COMMISSIONER: As well, all right.

THE WITNESS: All right.

THE COMMISSIONER: So, what is the distinction? I am sorry, I think you have lost me at the moment. What we saw earlier was a screening process for all these other types of stimulants; right?

THE WITNESS: Well, stimulants and narcotics, and so on and so forth, diuretics. Basically the screening is done here, as you can see, by either high

performance liquid chromatography or gas chromatography.
Screening procedures.

THE COMMISSIONER: The screening procedures
for anabolic steroids then is a different combination; is
5 that what you are telling us.

THE WITNESS: That's right. The detection
device used in these screening procedures is not sensitive
enough to detect low concentrations.

THE COMMISSIONER: That's as a result of
10 Professor Brooks' work and study, this is the way it is
now done; is that what you are saying?

THE WITNESS: Not quite. The way Professor
Brooks has been doing it was useful in the late seventies
we used that -- we used this technique in Montreal as a
15 screening technique, but when further work and research
was done in the late seventies and early eighties, the IOC
Medical Commission decided to abandon Professor Brooks'
method in favour of a method based on gas
chromatography-mass spectrometry. For seven years now,
20 almost eight, the technique of choice used in the all IOC
accredited laboratories is gas chromatography-mass
spectrometry to the exclusion --

THE COMMISSIONER: Which is the same as you
have for blocking agents; isn't it?

25 THE WITNESS: You can use that for blocking

agents, yes.

THE COMMISSIONER: It is the same
designation I see.

THE WITNESS: That's right.

5 THE COMMISSIONER: All right. Well,
perhaps we will pursue that further at 2:30.

Thank you very much.

--- Luncheon recess.

10

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25

--- Upon resuming.

THE COMMISSIONER: Mr. Armstrong.

MR. ARMSTRONG: Thank you, Mr.
Commissioner.

5

MR. ARMSTRONG:

Q. Now, Professor Dugal, I think we had --
I said "we", you had some additional overheads prepared
and I am just going to ask you to continue with those and
10 after we get you wired for sound here.

A. Thank you.

THE COMMISSIONER: All right. Mr. Dugal.

THE WITNESS: Thank you, Mr. Armstrong. My
last set of overheads, Mr. Commissioner, are simply a
15 review, if you wish, of what was said this morning by
using a specific example --

THE COMMISSIONER: Okay.

THE WITNESS: -- which was mentioned in
this -- in these hearings on several occasions.

20 THE COMMISSIONER: Thank you.

THE WITNESS: And just to illustrate the
fact that mass spectrometry is a technique that identifies
a molecule beyond a shadow of a doubt, first. And two,
that it cannot confuse two molecules together.

25 THE COMMISSIONER: Okay.

THE WITNESS: And I am going to use the example that was --

THE COMMISSIONER: We have heard of.

THE WITNESS: -- that you have heard of and
5 try in a few pictures to show you that although there are some similarities from the structural point of view, that these are two entirely different compounds and give rise to fingerprints which are entirely different from each other as well in manner.

10 So, again, you can see here that Stanozolol and Furazabol are very similar in the sense that part of their structure here is identical. And that the last part on the left-hand side of the molecule is similar in the sense that each of the compound contain two nitrogen
15 atoms, symbolized by N here, but slight differences in the sense that Furazabol contains an oxygen atom and Stanozolol a carbon atom. But then when you look at these structures as such you might conclude that they might give rise to similar if not identical mass spectra if you
20 didn't know any better.

And let me again give you furthermore to illustrate my point. Furazabol and Stanozolol's major metabolites which are hydroxylated in what is called here the 16th position, and again, here the same thing. And
25 you can see that although they give rise here to similar

fragments 218, 231, that the molecule weight, or the intact Chinese vase if you wish, have different weights.

THE COMMISSIONER: Only one, though.

5 THE WITNESS: I will show you more as we go along.

THE COMMISSIONER: So far I see 490 against 560, the rest are the same?

THE WITNESS: That's right.

THE COMMISSIONER: 218 and 233.

10 THE WITNESS: That part of the molecule will be different in each case and I will show you in a moment.

This is just to show that in this particular case, with this part of the vase, some fragments are identical and that the whole vase --

15 THE COMMISSIONER: Others are not.

THE WITNESS: -- has a different weight in both cases.

THE COMMISSIONER: Thank you.

20 THE WITNESS: Moreover, as you can see, the retention time of the metabolites of Furazabol is 35.1 minutes. While that of the major metabolite of Stanazolol is 36.3 minutes, which is another means by which the two molecules can be distinguished.

THE COMMISSIONER: Thank you.

25 THE WITNESS: To illustrate further, again,

this is a comparison of the mass spectrum of Stanazolol and Furazabol major metabolites, the same structures that we saw in the previous overhead.

5 You can see here again common fragments 218, 231. You can see also that the relative numbers of the major ions are significantly different including what is called the molecule ion which for Stanazolol has a mass of 560 and for Furazabol, the metabolite of Furazabol 490.

10 So, all these individuals ions as well as the full picture together allows us to make a difference between two compounds which are extremely similar or at least at first glance extremely similar in structure.

THE COMMISSIONER: Thank you very much.

15 THE WITNESS: And to further illustrate the point if -- I don't want to try your patience here, but again this illustrated a negative test for Stanazolol and a positive test for Furazabol. The arrows indicate the expected time of emergence of the major metabolites.

20 You can see here that there is basically nothing, a bit of background noise, but essentially nothing as well as for the major metabolites.

By contrast, if you look at the time scale here quite different from the upper frame.

25 THE COMMISSIONER: Well, one is a negative test and a positive test; what does that mean?

THE WITNESS: Well, negative test for Stanozolol. In other words, we are looking for Stanozolol in the sample that contains Stanozolol.

THE COMMISSIONER: Right.

5 THE WITNESS: Excuse me --

MR. ARMSTRONG: Furazabol?

THE WITNESS: I will rephrase that. We were looking here for the presence of Stanozolol in the presence --

10 THE COMMISSIONER: Of Furazabol.

THE WITNESS: -- of Furazabol. You can see that the test is negative for Stanozolol.

THE COMMISSIONER: Positive for Furazabol.

15 THE WITNESS: Positive for Furazabol. You will get an emergence here of coincidence of the three major ions, 402, 387, 143, and so forth.

THE COMMISSIONER: That's another distinguishing factor then?

20 THE WITNESS: That is correct. I see that further overheads will not be necessary because the point has gotten across, although perhaps you can see furthermore here a positive test for Stanozolol as well as a positive test for Furazabol. We are always talking here screening procedures MG-MS. You can see emergence here of
25 three ions, different masses, different fragments for

Stanozolol and here for Furazabol.

You look at the time scales, they are different. Look at the fragments, they are also different.

5 THE COMMISSIONER: I see. Thank you.

THE WITNESS: Okay. That concludes --

THE COMMISSIONER: We had a similar test made on our own, you know. I don't know if you know about that.

10 THE WITNESS: Yes, yes, I am aware of that.
That concludes, Mr. Commissioner, my formal presentation.

THE COMMISSIONER: Thank you very much.
Mr. Armstrong.

15 MR. ARMSTRONG:

Q. You did have an overhead that you showed Mr. Nunn and I last night in respect of clearance times. Do you have that in your group or did you --

20 A. Yes.

Q. -- discard that. We spent so much time on this Inquiry talking about clearance times in an anecdotal sense that it might be useful to see what information you have.

25 A. Okay. This is an attempt to summarize

how the total clearance of a drug is influenced by a number of factors. The point being here that total clearance by certain means of administration, particularly the intramuscular administration, is for all intents and purposes unpredictable.

Clearance is essentially controlled by two factors. I won't go into this, but take my word for it, if you wish, volume of distribution, which is an index of how a drug is distributed in the body and determinable rate constant, which is essentially the half life.

THE COMMISSIONER: The what?

THE WITNESS: In other words, the half life of a drug. The time that it takes for a drug to be -- or for 50 percent of a drug present to be excreted in time.

So, if the half life is long, the persistence will be long. If the half life is short, the persistence will be short.

THE COMMISSIONER: Well, digressing for a minute, all these tests are done as a result of a urinalysis? These all depend on urinalysis?

THE WITNESS: Yes.

THE COMMISSIONER: Would there be any difference if you did there on a blood test at all?

THE WITNESS: There is difficulty with blood tests, and they are well-known. First of all, when

blood, the withdrawal of blood from an athlete is or for most people is a tramatic experience.

THE COMMISSIONER: I thoroughly agree.

5 THE WITNESS: Yes. And taking blood right after an event is something that at the IOC level, anyway, we don't feel is --

THE COMMISSIONER: I am not advocating it, I am just wondering whether there would be a difference in the analysis, or whether one would be more -- not
10 practical, would it be more significant than the urinalysis or less?

THE WITNESS: No, it would not for a number of reasons.

15 The first one is that drugs and blood are present in much lower concentration than they are in urine. So, the analysis is facilitated by the use of urine.

20 Two, from a chemical, if you wish, or physical-chemical point of view, and you may find this strange, but blood is a much cleaner material to work with -- excuse me, urine is a much cleaner material to work with than blood.

It is easier, in other words, to process urine than blood.

25 And three, of course, there is a factor of

volume involved.

It is much easier to obtain 75 milliliters
or 100 milliliters of urine than it is to obtain 5
milliliters of blood. It is a question of practicality,
essentially.

5

THE COMMISSIONER: I have taken you off
your course. Do you want to talk about this and talk
about clearance time for urine.

THE WITNESS: This is to illustrate the fact
that the factors that govern the excretion of drugs are
influenced by quite a number of factors.

10

First of all, by the water or the relative
water lipid solubility of the drug, total body fluid, the
fat content of the body, the lean tissue mass, as well as
the tissue blood flow rate.

15

For its part, the half life is influenced by
the rate of metabolism which differs from individual to
individual and from steroid to steroid, and is highly
dependent on liver blood flow, enzyme activity, and, of
course, integrity of the liver, which is the main organ
for drug metabolism.

20

And finally, the urinary excretion, which is
linked in to all of this also, depends on a number of
renal processes as well as the absence or presence of --

25

THE COMMISSIONER: Well, are you saying

that one athlete may have different clearance time than another athlete for the same drug, same quantity?

THE WITNESS: Quite correct. Of course, other factors which influence this are the dose of the drug, the nature of the drug, the frequency of use,
5 previous medical history and a host of other factors.

THE COMMISSIONER: How does a masking agent fit into into this picture, like Probenecid, for example?

THE WITNESS: Okay. I think I have
10 something on this, let me show it to you. Again, I will ask for your indulgence because there is a previous explanation necessary before I answer your question.

THE COMMISSIONER: Go ahead.

THE WITNESS: There are essentially three
15 processes by which drugs are excreted or reabsorbed by the kidney.

The first one is passive elimination. In other words, drugs just pass on from the blood to the kidney and to urine by a passive process. They are just
20 being passively or they traverse membranes passively.

The second process is active tubular secretion. And this is a rather complicated rapid process, but it is essentially think of a commuter bus. It takes people, carry them to a certain place, and then
25 goes back, carries more people over again.

This is what the kidney does. It has an active transport enzyme system that can draw literally some molecules from the renal blood flow into the urine. Okay.

5 This is a process that accelerates, of course, the elimination of certain compounds.

And finally, there is passive reabsorption. And as you do remember, we dealt with that particular process this morning.

10 THE COMMISSIONER: All right.

THE WITNESS: Now, Probenecid, and possibly some of its congeners, we don't know that yet, but certainly for Probenecid it is a fact that the transport mechanism or the enzyme system here is literally saturated by Probenecid to make it saturated.

15 THE COMMISSIONER: I understand. It is just not going to flow, is that what happens?

THE WITNESS: That's right. I mean, the bus is full, it won't take any more people.

20 THE COMMISSIONER: Right.

THE WITNESS: And, therefore, those drugs which would be normally secreted by and excreted by these processes, will not. They will stay in the blood stream because this system is inhibited by drugs such as Probenecid.

25

THE COMMISSIONER: All right. Thank you.
Mr. Armstrong.

MR. ARMSTRONG:

5 Q. All right. Now, during the course of
Dr. Astaphan's evidence, he mentioned a drug called, I
believe, dihydrotestosterone and a suggestion from him was
either that that was not detectable or difficult to
detect. What do you say about that?

10 Is your lab able to detect
dihydrotestosterone and are the other IOC accredited labs
able to detect dihydrotestosterone?

A. Dihydrotestosterone is the active
metabolite of testosterone. It is present, of course, in
15 blood. It is present at tissue receptors of androgens.
It is also excreted in urine.

It is -- it was news to us that this
substance would be used as an anabolic steroid because it
is high androgenic.

20 In other words, from what -- from my
presentation this morning about the ratio of anabolic to
androgenic activity, dihydrotestosterone would be expected
to have a ratio of one to one or even inferior to that.
In other words, it is almost a pure androgen.

25 The drug is excreted in urine, but again it

has not been made, at least in Montreal, it has not been yet introduced into the detection system. There is a new method which has been developed by again by Professor Brooks in England and which will be published very
5 shortly. And it involves the ratio of dihydrotestosterone to some other metabolite much like the ratio of testosterone to epitestosterone is used to detect testosterone abuse.

10 So, we are working on a suitable method in GC-MS for this particular compound.

THE COMMISSIONER: I think you can be seated now, Professor.

THE WITNESS: Thank you.

15 MR. ARMSTRONG:

Q. Well, let me just sum up your last answer. I take it at the present time then that your lab and the other IOC labs don't test for dihydrotestosterone?

20 A. I cannot speak for the other labs because they may have had recent work in order to detect dihydrotestosterone. We are working on there in Montreal and we expect a test to be available very shortly, and within the framework of the screening and identification of anabolic steroids.

25 Q. Then there was another drug that Dr.

Astaphan mentioned Carinamide?

A. Carinamide.

Q. Carinamide, the so-called golden boy of
the blocking agents or masking agents. And are you
5 familiar with Dr. Astaphan's golden boy? And if you are,
can your lab and the other IOC accredited labs test for
it?

A. Yes, I am familiar with what Dr.
Astaphan called the golden boy. Let me tell you briefly
10 about there.

Carinamide was a drug developed in the early
fifties for the specific purpose of serving as a blocking
agent of penicillin excretion when penicillin was rare and
in great demand and very costly.

15 The purpose of the development of this drug
was again to block renal excretion such that the
persistence of penicillin in the body would be longer.
Therefore, the administration of it would be made instead
of every two or three hours, every 8 or 12 hours. So, it
20 was a drug developed for that purpose.

However, it turned out that the doses that
had to be administered in order to effectively control
penicillin excretion were very great, of the order of five
to six grams a day, which for a drug is enormous. And its
25 use was rapidly abandoned when a further search of similar

molecules ended in the discovery of Probenecid.

Probenecid is a compound which is chemically and pharmacologically related to Carinamide, and it is the drug which has been used for last 30 years for the treatment of gout, notably, and also to prevent the excretion of certain drugs, such as pencillin. Although, this is no longer necessary because there are some pencillin derivatives on the market that are long acting, and long persisting.

Q. So, Probenecid, how long has there been available on the market?

A. It was discovered in 1954 or '53. I think it has been -- it was put on the market in '57 or '58. I don't have the exact figures --

THE COMMISSIONER: You can detect Probenecid now? That is detectable, Probenecid?

THE WITNESS: Oh, yes. And Carinamide also because a drug administered in such high dosage, of course, and it has a short half life on top of it, is excreted massively in urine.

If athletes had been using the substance, we are positive that we would have seen it, detected it, in the usual screening procedures that we use.

MR. ARMSTRONG:

Q. That's Carinamide?

A. Carinamide and Probenecid, of course, which is administered --

5 THE COMMISSIONER: But there is a clearance times for both those two, I gather? Of course, they wouldn't be used for clearance times because they would be -- try to be effective at the time of testing.

10 THE WITNESS: That is correct. Blocking agents such as potentially Carinamide, which I don't think is no longer on the market, I haven't been able to find a trade name in the compendia that were made available to me, but certainly Probenecid to be effective would have to be administered a couple of hours before a test. It would
15 block --

THE COMMISSIONER: The weightlifters gave evidence about some masking agent which was given to them in Czechoslovakia. I think you have got a couple of those pills?

20 THE WITNESS: That's correct yes.

THE COMMISSIONER: What were those?

THE WITNESS: Citric acid.

THE COMMISSIONER: Are they an effective masking agent?

25 THE WITNESS: I don't know. Citric acid is

a natural occurring compound, and it is present everywhere, including such drinks as 7-Up. It is -- it probably acidifies urine. What we don't know at this point in time, and we were not able to find any kind of supportive literature reference, is whether this compound is able to block anabolic steroids excretion or not.

THE COMMISSIONER: I see. Is it detectable?

THE WITNESS: Yes, it is detectable.

THE COMMISSIONER: I gather it was new for you, was it?

THE WITNESS: It was new for me.

THE COMMISSIONER: The weightlifters handed it to us when we were sitting in the hotel in Montreal.

THE WITNESS: My personal opinion is that this particular masking agent was probably a very expensive placebo for our athletes. It seems to me that --

THE COMMISSIONER: We were told if they took I think 10 milligrams within an hour or so or two hours to test that that would be effective?

THE WITNESS: The quantities, Mr. Commissioner, I think was --

THE COMMISSIONER: With three pills within two hours? You know what it was. I haven't read it for a

long time.

THE WITNESS: I read these transcripts a few months ago. I believe they were taking or three capsules every 10 minutes for an hour or two hours.

5 THE COMMISSIONER: That's right, within about two hours of the test.

THE WITNESS: That's right.

THE COMMISSIONER: We don't know whether it was effective or not of course?

10 THE WITNESS: We don't know for a fact, but I think there was testimony to the effect as well that these athletes were instructed to stop at least 15 or 21 days before the test. I would suspect that selling of these masking agents apparently at a fairly high price was
15 a device used to generate Canadian currency or American currency in a certain country.

THE COMMISSIONER: All right. Well, we have got enough problems.

20 MR. ARMSTRONG:

Q. All right. Then, I take it from what you have just said in the last few minutes that from time to time in your work that you are in you become aware of additional drugs that athletes use either for perceived
25 performance-enhancing purposes or for masking agents or

blocking agents or whatever?

A. That is correct. It is a cat and mouse game, yes.

5 Q. When you become aware of the existence of a new drug or new substance, steps are taken to add it to the banned list if it seems appropriate to do so based on the available evidence?

10 A. Quite so. There is a case in point which I may relate to you, although Professor Donike is much more familiar with the particularities, but as soon as the use of Probenecid was discovered in 1987, that was in June, early June or middle of June of '87, fast action was made at the IOC level to ban its usage. The use of Probenecid was banned in October of 1987.

15 So, it was a case where international action was quite rapid and speedy.

20 Q. What had happened in June of 1987 or the spring of 1987 was that certain athletes in a random test by their own national federation tested positively for Probenecid. Is that not so?

A. That is correct, yes.

Q. And a kind of warning light went on for Professor Donike and for you and others?

A. That is correct, yes.

25 Q. Then really the crowning achievement or

not the crowning achievement, but the crowning incident to lead you to take action to put Probenecid on the banned list was in fact a number of positive tests for Probenecid at the 1987 Pan-American Games; is that not so?

5 A. That was one element. I don't recall exactly the number of positives that were found at the Pan-Am Games, maybe three or four on Probenecid, but previously to that in the random -- in the context of an out-of-competition test conducted by a certain country,
10 Probenecid was also found and that was two months before the Pan-American Games as such. The triggering factor, in other words, was the first incident.

 Q. The first incident say is June of 1987. When were the Pan-American Games, it must have been July
15 or August in Indianapolis?

 A. Yes.

 Q. Then there was a meeting in October of '87?

 A. That's correct, late September or early
20 October.

 Q. All right. The triggering incident, as you call it, related to the athletes in one sport, one country?

 A. That's correct, yes.

25 Q. Then in the Pan-American Games in 1987,

do you know what sport the three or four positives for Probenecid came from?

A. I do not, sir.

Q. Do you know what country the athletes came from?

A. I do not.

Q. In any event, the fact of becoming aware of those positives for Probenecid certainly led you to conclude that these athletes weren't taking Probenecid because they suffered from gout or one of the other therapeutic reasons for taking Probenecid?

A. That is correct, yes.

Q. You have concluded that they were using Probenecid as a blocking agent probably for something like anabolic steroids?

A. Exactly. It has been known actually for almost 40 years now that Probenecid is able to block the excretion of natural steroids. So, there was evidently some people somewhere counseling athletes on the use of this particular substance for blocking purposes.

Q. Although there were these positive tests at the Pan-American Games in 1987 for Probenecid, Probenecid of course wasn't on the banned list. So, those athletes would not have had any disqualification or any other penal action taken against them?

A. That is my understanding, but I don't have a first-hand knowledge of that.

Q. Then I am going to be asking Professor Donike about something called the natural steroid profile which has also been referred to during the course of these
5 hearings I think as the endocrine profile or the steroid profile. But I wanted, not to be faced with a lost opportunity with you in the stand, I wanted to ask you about that as well.

10 First of all, can you in your own terms casting it at the same layman's level that you have been doing so well today, tell us what is the natural steroid profile?

A. I wish I had brought some pictures with
15 me. Very simply, testosterone is excreted in urine along with a number of metabolites.

If you recall this morning, and that, of course, that gives rise to a certain profile and GC-MS. You get peaks which are separated from each other.

20 Within a certain concentration range which, of course, varies from individuals to individual, but you can make an average with some kind of standard deviation.

Normally, for example, in most people who are not taking testosterone, the ratio of testosterone to
25 epitestosterone is about 1, 1.1. That was first

elucidated through research by Professor Donike in Cologne in the 1980's, early 1980's. So, I would defer to him at least for further explanation.

5 In addition to that, there are two metabolites respectively called androsterone and ACO colananone (phon), metabolites of testosterone which are also excreted at the same time. And that also gives rise to certain peaks in mass spectrometry.

10 It is possible that these -- that the relative concentrations and ratios of all these substances be modified by the administration of steroids.

15 Q. So, put in simplistic terms, if you can do a graph showing the natural steroid profile of an athlete who has not taken any steroid of any kind at any time, presumably subsequently after he takes anabolic steroids exogenously, you can show whether or not his normal or natural steroid profile has changed; is that right?

20 A. If you had a baseline value in such an instance it is probable. I am not say for certainly, but I am saying it is probable.

25 In all these values are so-called biological constants and have to be established after the study of fairly large populations in order to obtain statistically valid values which serve as baseline for comparison to

those athletes which would be taking anabolic steroids.

Q. Well, let's if you -- take an athlete who has never taken anabolic steroids and do one of your analysis of his urine sample, and I presume you can, in
5 whatever testing techniques you have available that you have described, show on a graph what that athlete's natural steroid profile is, right?

A. You know, we have not personally conducted research in this area. We have focussed our
10 efforts in Montreal at least on drug metabolism. Other people, such as Professor Donike, are involved in this type of research. I would much rather defer to him to explain this more fully to you.

Q. All right. So, if, for example, you
15 are doing the tests this weekend for the Canadian National Championships in Ottawa of the Canadian Track and Field Association and you do tests on male athletes, do you look at the steroid profile of those athletes?

A. The profile is automatically generated
20 by the type of method that is used. We can detect not only synthetic anabolic steroids, but as well we can detect as well testosterone and its metabolites as well as epitestosterone.

So, we do generate indeed a profile, but we
25 have so far not done enough work as far as we are

concerned in Montreal to conclude to something useful as far as that is concerned. Some other people again have been making systematic research work in that area and they would probably be a lot more informative to you.

5 Q. And in any event, what -- let me see if I have got at least this. I take it what you have told me is that by virtue of the test that you do or the tests that you do, that kind of information is just automatically available for those that are skilled in
10 examining this issue of the natural steroid profile or endocrine profile, whatever it is?

A. Yes, in most cases, yes. It has occurred in the past, for example, that we had samples where the endocrine profile as you and I now call it, has
15 been depressed significantly compared to "normal" values, and at times have been totally suppressed. And that may have been due to a previous steroid administration, but a synthetic steroid was no longer present in that sample because it had cleared.

20 You do remember this morning that I told you that testosterone production may take quite awhile to be restored to a normal level. It may take several weeks.

Now, if an anabolic steroid having a short half life had been administered consistently, it is quite
25 possible to have no synthetic steroid left while the

natural androgen profile is still depressed. It is a question of time.

Q. Now, in order to be able to say that the natural steroid profile or the endocrine profile is suppressed, do you have to know or is it necessary to know what the normal level is?

A. Yes, of course, at least a range of normal values. That is a mean and some variation around the mean.

Q. All right.

THE COMMISSIONER: I take it, though, that in your practice before you come up with a positive finding, you would not rely on the endocrine profile as a basis for that finding, are you saying? You rely on your tests? Let's assume you want to find Dianabol, and you go through your hieroglyphics as they were, and with the various peaks and so on that I am satisfied that's Dianabol, right.

THE WITNESS: Yes. The evidence for positive --

THE COMMISSIONER: Pardon.

THE WITNESS: The evidence for a positive result at this point in time is the finding of a synthetic steroid.

THE COMMISSIONER: Yes.

THE WITNESS: Or its metabolites and of testosterone-epitestosterone value in excess for six for testosterone misuse.

THE COMMISSIONER: Well, in excess of six.
5 You are talking about the profile, aren't you? You are talking about the -- that's the ratio are you are speaking about?

THE WITNESS: I am talking about the ratio, yes.

10 THE COMMISSIONER: Would you rely on the ratio as a base of a finding or do you have to rely on the spectrum that you see --

THE WITNESS: If the ratio, for example, of testosterone to epitestosterone turned out to be 10, in a
15 sample it would be six and therefore positive. There is a lot of other interpretation that goes into the decision, but essentially the value of 10 stands by itself as a positive test.

THE COMMISSIONER: Let's put aside the
20 profile and or just if all you had was the profile and no other evidence in your test that an anabolic steroid was found in the urine, would you rely on profile by itself?

THE WITNESS: At this point in time, no, but
25 it may be that in the fairly near future we will have enough values to make that judgment.

THE COMMISSIONER: Because you could discover the profile even though if you say that the athlete by that time had cleared the actual substance from his sample; is that right?

5 THE WITNESS: That is correct, yes.

THE COMMISSIONER: So you could have in a sense a negative finding on the urinalysis test, if you are only looking for the actual existence of the substance in the body, it would still would have a high endocrine profile which would indicate the use of steroids at some
10 past period of time.

MR. ARMSTRONG: Low endocrine profile.

THE COMMISSIONER: Low endocrine profile.

THE WITNESS: That's why research is being
15 done in this area at the present time in order to increase our retrospectivity of anabolic steroid detection through the use of that profile.

THE COMMISSIONER: But in your tests, though, you have to actually find the substance in the
20 urine?

THE WITNESS: That is correct.

THE COMMISSIONER: Before you make a find positive finding?

THE WITNESS: That is correct, yes.

MR. ARMSTRONG:

Q. Just to follow up from the Commissioner's comments, it is clear that that is what the Olympic rule, the IOC rule is that, for example, let's
5 take Ben Johnson. If he had tested negatively for the presence of Stanozolol or any other anabolic steroids yet had a suppressed endocrine profile, there would have been no positive finding?

A. That is correct.

10 Q. And that would be the same for any other athlete. Indeed, there may well be evidence of suppressed endocrine profiles suggesting the taking of anabolic steroids during the training period, yet a negative finding at the time of competition for the
15 presence of the metabolites of steroids?

A. That's right.

Q. Which enables the athlete to go scott
free even though there may be evidence that he has taken the anabolic steroid during the training period; is that
20 not so?

A. Well, the rules as they now stand call for identification of the particular substance that was administered.

The profile, or the endocrine profile at the
25 present time, is a research instrument. I think we are

very close to defining those normal values. And again, I believe that you intend Professor Donike to deal with that extensively tomorrow. I personally don't feel very much at ease with this because we haven't conducted in Montreal
5 the type of research that is been conducted in Cologne.

Q. Okay.

A. And other places.

Q. Very well. Let me ask you something that I am sure you do feel at ease with, and looking at
10 the list of banned substances as published by the IOC Medical Commission prior to the Seoul Games, and marked as Exhibit 18 in this Inquiry, under the listing of anabolic steroids, the last compound to be -- or the last steroid to be listed is testosterone with an asterisk. If you
15 read the asterisk it says: "Testosterone, the definition of a positive depends upon the following. The administration of testosterone or the use of any other manipulation having a result of increasing the ratio in urine of testosterone-epitestosterone to above six."
20 Correct?

A. Yes.

Q. Now, I take it that when you were running a test for banned substances, without question in every case, you calculate the testosterone-epitestosterone
25 ratio, do you?

A. That is correct, yes.

Q. And I take it that if on the calculation you get a result that is above six, that you conclude that that is a positive finding for testosterone?

5 A. If the -- yes, if the coefficient of variation around the mean is -- makes it undoubtable that the ratio is above six.

Q. Well, you added some language that I must confess I didn't understand. I would have thought
10 that if the arithmetic showed, as the rules says, that the ratio of testosterone-epitestosterone is above six, that's it.

A. No, it is a basic --

Q. You are gone?

15 A. It is a basic rule of chemistry that there exists such things as -- such a thing called experimental error. In other words, the methods, the quantitative methods allow for certain variations across the mean. And if a value, for example, of, assume, 6.0
20 was found, a mean value was found after injections of maybe three or four different aliquots injected themselves, three or four times, therefore generating 12 values, and the mean was six with a deviation of plus or minus 0.3 around that mean, which means then 6.3 -- values
25 would be then 6.3 to 5.7, a reasonable doubt would exist.

But this is a hypothetical case.

Q. I see. So, well ordinarily if you are testing in the manner that you suggested this morning, you take what, eight or nine extracts; is that it?

5 A. No, those aliquots were for different procedures. What I am talking about now is the quantitation of testosterone which is the question you asked me.

10 THE COMMISSIONER: In other words, there is a safety valve in the --

THE WITNESS: There is a safety valve in the protection of the athlete.

15 THE COMMISSIONER: That's right. If you came out exactly six, you might not be certain it could have been 5.9 or 5.8?

THE WITNESS: The mean of several determinations, we will take that example for the purpose of this discussion.

20 If the actual mean of several determinations would have been 6, take 12 determinations for example, and that the variation around that mean, the standard deviation, mathematically --

THE COMMISSIONER: Is .03 you say?

25 THE WITNESS: -- .03, then the value with 95 percent of confidence would be 6.3 to 5.7. And

hypothetically again a doubt might exist as to --

THE COMMISSIONER: Because the actual reading may be a 5.7?

THE WITNESS: That is correct.

5

MR. ARMSTRONG:

10

Q. Well, I don't know, I guess out of an abundance of ignorance it leads me to ask why do you get readings that in one case may be 5.7, another case may be 6.1, in another case might be 6.2?

15

A. Because we are dealing with decimal places and the quantitative analysis. And this is not only in drug testing in athletes, but in every field of chemistry, contains some experimental errors. And it is well accepted today that both in quantitative gas chromatography and quantitative mass spectrometry there is some variability around mean determinations.

20

THE COMMISSIONER: All it shows, Mr. Armstrong, is that science isn't nearly as exact as the law.

MR. ARMSTRONG: I have been learning that for the last 10 months. Just could I have your indulgence.

25

THE COMMISSIONER: There would be very few cases where it would be so borderline, I guess?

THE WITNESS: Very few cases I would imagine. I am not familiar with all the testosterone-epitestosterone cases that we have had in the last -- that is that have been found --

5 THE COMMISSIONER: Well, anyway, I think Dr. Donike will expand on this probably.

THE WITNESS: Probably, yes, perhaps.

THE COMMISSIONER: I interrupted you, Mr. Armstrong, I am sorry.

10 MR. ARMSTRONG: Yes, thank you.

MR. ARMSTRONG:

Q. All right. Then, one of the general issues that has emerged during the course of the last
15 several months of this Inquiry is what other kinds of testing may be of benefit to controlling the proliferation of performance-enhancing drugs. And, indeed, the Commissioner referred this morning to some of the things that are being done elsewhere.

20 There have been suggestions in Canada that we may have more out-of-competition testing in some sports.

25 What are the laboratory facilities that are available in Canada to deal with increased testing? First of all, let's talk about your lab, and are there any other

laboratory facilities available in Canada?

5 A. There is, of course, the Montreal lab which is IOC accredited. There was also a laboratory formed for, as you well know, for the Calgary Games. It is presently in a status of suspension from IOC accreditation, but eventually, I would assume, I suppose, that this particular laboratory could be used also if the number of samples were to be increased significantly assuming that it gets IOC re-accreditation.

10 However, it must also be stated as a matter of principle that as the number of samples go up or the number of analysis go up, the cost is brought down.

15 And very briefly, an example if for -- if the number of tests were to be increased to say 4,000 per year it would be much cheaper to have those processed in the same lab rather than to divide them equally between the two labs, because maintenance of an infrastructure, of a basic infrastructure, maintenance of the qualifications of -- qualifications of personnel and so forth are
20 extremely costly. And there is a breakeven point above which testing is significantly cheaper.

25 Q. Well, I guess what you are saying is that the facilities are certainly available in Montreal and you still have some capacity that could do more testing if that were one of the eventualities that came

out of all the initiatives that presently exist on the anti-doping scene?

5 A. Well, the basic -- the basic infrastructure, of course, exists and the expertise has been present for at least 15 years.

10 It is difficult for me to say, but I do believe that the Montreal facility has become an international resource and a national resource of some importance. And increasing again the number of tests would effect, of course, the number -- the purchase of other instruments and hiring more personnel to handle the through put and the flow of samples, and that would certainly contribute to decrease the cost per unit, if you wish.

15 Q. Now, what about the cost? For example we know, it is on the public record both here and I assume elsewhere, that -- and you will correct me quickly if I have forgotten the figures, but my recollection is that your contract -- not your contract, but the contract of
20 INRS Sante with the Sports Medicine Council of Canada is for \$400,000.00 a year to do up to 1,200 tests, but the figure I think was calculated on the assumption that you would do about 1,000, and once you did 1,200 then the Sport Medicine Council of Canada had to pay more, I think.

25 Maybe I have unfairly described it, but have

I got it right, that that's what your contract provides for?

5 A. The contract provides for -- I think it is \$400,000.00 a year for up to 1,200 samples. We have never analyzed more than 1,200 samples a year. So, therefore, the question has never presented itself.

10 Q. Let's take the 1,000 figure. Assuming, and I think that's what Dr. Pipe told us and Ms. Hoffman from Sport Canada, they were sort of targeting 1,000 and you said you did 1,000 last year. Is that roughly in today's dollars the cost of doing 1,000 tests, and can you say then that at the present time at that level the cost of running one of these tests that you have described is \$400?

15 A. I don't think that's a proper way of putting it, Mr. Armstrong. When I devised the budget first in 1983 or early '84, my budget was established on both the testing activities and the research programs that I felt had to go for the testing itself to maintain it
20 competent.

 So, a budget was established by ventilating, if you wish, each budgetary post in salaries of personnel, supplies that were necessary to conduct both the testing and the research, equipment replacement because these --
25 this type of equipment ages rapidly when it is used day in

and day out. And, of course, the research activities which I felt at the time again were necessary to provide Canada with a competent doping control program. In other words, to generate technology instead of importing it.

5 And that budget then was established on that basis. Again I insist including research activities and other types of services. And I have calculated --

THE COMMISSIONER: Does that include the cost of any replacement of your equipment or is that --

10 THE WITNESS: Yes, it does, sir. There was a budget allocated of approximately 60 or \$70,000.00 a year for purposes of equipment replacement.

I might add to this that my own institution has contributed in a very significant way to this program.

15 The total cost of running this per year is in excess of \$400,000.00.

For example, my own salary is not budgeted in this particular sum or amount, nor is that of my senior faculty members, nor is the extensive travel I have to do

20 when I am acting as scientific advisor to the Canadian Ministry of Fitness and Sport.

MR. ARMSTRONG:

Q. I am assuming in fairness, though,

25 your travelling expenses when you are travelling for

Fitness and Amateur Sport are charged to Fitness and Amateur Sport not coming out of the INRS Sante?

A. No, they partly come from the SMCC or Sports Canada contract, if you wish, but it is a minor part of it . Most of it is charged either to the
5 institute itself or to other grants or research contracts.

Q. I see.

A. Because there is a limitation in the contract itself to three or \$4,000.00 of travelling per
10 year. So, I just charge it to other sources.

Q. All right. In the \$400,000.00 figure then are you -- you are certainly covering your overhead and expenses. I take it you are not a profit --

A. No.

Q. -- earning institution. So, I take it there is nothing worked into the \$400,000.00 for profit?
15

A. The \$400,000.00 figure is intended to cover direct costs.

Q. I see.

A. All indirect costs like energy, security, maintenance, salary of senior staff, library facility, computer facility and so forth are absorbed literally by the institute and the university such that this \$400,000.00 again is completely -- can be assimilated
20 to a grant from the Medical Research Council or the
25

National Science and Engineering Research Council, which fund only direct costs in most of their grant programs.

Q. Does the \$400,000.00, is that contract between SMCC and INRS Sante?

5 A. Yes.

Q. Or with the University of Quebec?

A. It is with INRS.

Q. All right.

10 A. INRS is the authority, if you wish, the institute. INRS Sante, of course, is one of the seven research centres that I mentioned this morning. The contract is with INRS as such.

Q. The \$400,000.00 goes directly into its treasury?

15 A. That's right, and channeled back to INRS Sante.

20 Q. Let's just for the sake of argument and this may not be argument, but for the sake of argument and this maybe totally unrealistic, I don't know, but let's just say the Sport Medicine Council of Canada wanted to double the number of tests in the fiscal year 1991, starting next March 31. Without sticking you hard and fast to a figure, if they wanted to double it, what might the cost likely be?

25 A. I don't know. I would have to sit down

for at least half an hour to figure it out given our present resources and so on and so forth, but certainly from a unit cost, which is now \$400, it would certainly decrease significantly.

5 Now by what percentage, I cannot tell you this right now because the increase in tests has an influence on research activities, on equipment, on equipment replacement and so on and so forth, personnel, of course.

10 Q. I understand that. Taking all of those qualifications into account and assuming you might have a half an hour tonight to do that, could you do that for us because one of the things that we as counsel may well do, we may be in the course of our submissions and argument
15 may be making suggestions to the Commissioner that there ought to be increased testing. And one of the things he may want to consider is how much is it going to cost the sports federations or the Government of Canada. And it may be helpful to us even with recognizing the
20 qualification that you don't know what the economic world is going to look like 1990 or '91, what salaries are going to be, what costs are going to be, but taking all that into account, do you think you might do that?

25 A. Oh, certainly. Certain assumptions can be made like a rate of inflation of five percent and

things like that in order to devise a suitable budget. I will do that for you, sir.

Q. Maybe you might do it on the basis that assume double the numbers of tests and assume triple the number of tests just so that we might have an idea.

A. Very good.

Q. Then during the -- let me ask you this: I am going to be asking Professor Donike when he is in the witness table about the organization and set up of the IOC Medical Commission, and, in particular, the organization and set up of the sub-commission on doping and biochemistry in which you are one of his colleagues as a member of that committee. And he is going to tell the Commissioner, I think, in his evidence that your committee is responsible for the accreditation of the 20-odd IOC laboratories; am I right?

A. Yes.

Q. And as I understand it, your lab at some point in time, the Calgary lab, the Los Angeles lab, and so on had to apply to the IOC Medical Commission through that sub-commission to become accredited?

A. As far as your mention of Calgary and others, yes, this is correct. But in 1980 when the accreditation scheme was first put into -- or was first implemented, the -- what the -- what were considered at

the time the peer labs, if you wish, the older labs, were automatically accredited and were submitted to re-accreditation for the first time.

5 Q. You were, to use another term of the vernacular, you were grandfathered, were you?

A. Kind of. There were five labs at that moment in the world. There were a lab in Moscow which has been developed for the 1980 Olympic Games. There was a lab in Kreicha, East Germany. The one in Cologne, of course. The one in London. And one in Montreal. All of these labs had been involved in Olympic Games and other type of international activities, and with various degrees been submitted to blind samples which they analyzed successfully.

15 At the time when the accreditation system was started up, those labs were considered accredited. And then further applications, which came in after 1980, were submitted to the accreditation scheme that existed at that moment in which you may know has been significantly improved upon last year.

20 Q. All right. When the five labs that you mentioned were accredited, was each one of the directors of each one of those labs including yourself a member of the sub-commission on doping and biochemistry?

25 A. I am trying to remember; it has been a

long time.

Q. Well, they certainly all are now, are they not? I haven't got the list here. But Moscow, Mr. Semenov is a member of committee; the East German gentleman isit Clausnitzer --

A. That's right.

Q. -- is a member of sub-commission. Dr. Beckett is a member of the sub-commission.

THE COMMISSIONER: He is not in charge of the lab any more, though.

MR. ARMSTRONG: Well, he was at that time.

THE COMMISSIONER: Yes.

MR. ARMSTRONG:

Q. And then, of course, Dr. Donike, and you.

A. Yes, that's right, but there were only five labs in existence at that time. We are talking about 1980.

Q. All right. Now, in addition to the accreditation process, there is a re-accreditation process. That's handled by the sub-commission on doping and biochemistry?

A. That is correct, yes.

Q. Now, I don't ask you this question for

the purpose of any attempt to embarrass you, but I do ask it to you because I consider it my obligation to do so in a hearing such as this.

5 It might be said that -- and I am not saying it, but it might be said that by virtue of the fact that you and Dr. Donike, I am going to ask him this question, but by virtue of the fact that you and Dr. Donike are directors of laboratories that are accredited, you are in somewhat of a conflict position if you are indeed sitting
10 on accreditation applications and re-accreditation applications of other laboratories.

 A. I think the process is conducted in a fair and professional and equitable manner.

 To give you an example, the last
15 re-accreditation in late January or early February, the laboratory in Moscow was submitted to a suspension that was equal to that of the other labs. So, the lab, directed by one of our members, was effectively suspended. So, again, we are trying very much and I think succeeding
20 in being fair and just --

 THE COMMISSIONER: Well, take the Calgary lab situation. In a sense, that could be regarded as a competitor of yours.

 THE WITNESS: In a sense, yes, I suppose so.

25 THE COMMISSIONER: Without that lab as an

accredited lab, you are the only one left in Canada.

THE WITNESS: That is correct, yes, for the moment.

THE COMMISSIONER: So, theoretically, I am
5 not saying this, there is more business available.

THE WITNESS: I --

THE COMMISSIONER: And if we double it --

THE WITNESS: I would not use the word
"business", Mr. Commissioner.

10 THE COMMISSIONER: I am sorry, more
opportunity to serve.

THE WITNESS: We are not a profit-making
concern.

THE COMMISSIONER: But whatever it is, and
15 I don't say that disparagingly, and if you double or
triple the number of tests as some people are suggesting
on a random basis, there would be more -- keep your lab
more busier than you are today.

What some people may fear is that you
20 shouldn't sit on a determination whether the Calgary lab
should be accredited or not in the future. I am not
suggesting that's the result. I am being more direct than
Mr. Armstrong.

THE WITNESS: Well, I abstained from the
25 decisions that were taken regarding the Calgary lab.

THE COMMISSIONER: You abstained from
the --

THE WITNESS: I abstained. I remember
distinctly, for example, when this was discussed in Nice
5 two months ago that I requested the Chairman, who was at
the time Professor Donike, to be excused from the room
while the Calgary case was being discussed.

THE COMMISSIONER: I see.

10 MR. ARMSTRONG:

Q. What about, for example, when an
application though for re-accreditation might come up of the
UCLA lab? It might be regarded as a competitor in the
sense of the way the Commissioner put it of yours and in
15 fact you are obviously doing -- the most significant
client you have is the NCCA?

A. Well, the NCCA has had in the last
three years the -- or was of the opinion, if you wish, and
has done it to divide its load into three laboratories.
20 Fifteen hundred samples or approximately are sent to UCLA,
1,500 are sent to Indianapolis and 1,500 are sent --

THE COMMISSIONER: There are two labs in
the United States, Indianapolis and California, is that
right?

25 THE WITNESS: That's right, sir.

THE COMMISSIONER: I just want to understand. So, when the accreditation or re-accreditation of the Calgary lab was in issue, you say you abstained from taking a position on it, you say?

5 THE WITNESS: That is correct. Now, to go back to answer your question fully, the NCCA processes about 4,500 sample per year, and a third is sent to those labs that I mentioned, including Montreal.

10 So, UCLA is not really a competitor. I don't think that the NCCA as an American organization would send all of its "business" to a Canadian laboratory. I don't consider my colleagues in the United States to be competitors.

15 MR. ARMSTRONG:

Q. What about the Indianapolis lab of course together with Moscow and Calgary were suspended. Did you sit on the consideration of the suspension of the Indianapolis lab?

20 A. Yes. Again, in Nice, two months ago because the -- I don't remember saying anything, but the Indianapolis lab --

Q. But you were there and you voted?

25 A. Yes, I do remember I voted to upgrade Indianapolis from phase two to phase one and the

components of that I guess will be explained to you eventually. But that was a positive vote, it was not a negative vote.

Q. I am sorry, I don't understand?

5 A. I voted for the upgrading of Indianapolis to a lower level -- from the lower level to a higher level --

Q. I see.

A. -- of accreditation.

10 Q. But in February it was suspended, though, for a period of time?

A. That's right, yes.

Q. And the meeting you are talking about in Nice was last June?

15 A. Yes.

Q. When Indianapolis was initially suspended, that was as a result of a meeting that was held on the first weekend in February in Cologne?

A. That is correct, yes.

20 Q. And I presume you sat on the deliberations in relation to Indianapolis and voted for its suspension in Cologne?

A. This is rather fuzzy. I don't really remember if there was a formal vote on that occasion.

25 Q. Well, I suppose you might be a bit like

some law partnerships, a consensus develops among the five of you.

A. That's what I was about to say, some kind of consensus did develop --

5

THE COMMISSIONER: Has Indianapolis been reinstated? I have lost track of this now. Indianapolis, has it been reinstated?

MR. ARMSTRONG: No.

10

THE WITNESS: It's partly reinstated. We will have to go into an explanation, Mr. Armstrong, of phase one and phase two, I guess, in order to make this understandable.

THE COMMISSIONER: All right.

15

THE WITNESS: What was decided then was the definition of two phases.

Phase one implicated that these laboratories for having failed a number of samples or for having not provided acceptable documentation were suspended in what we called at the time phase one.

20

Phase one meant that they could accept samples from athletes from their own country, but they could not accept samples from events with international participation.

Moreover the samples --

25

MR. ARMSTRONG:

Q. So, they could do a high school track meet or a NCCA, a local track meet.

THE COMMISSIONER: Domestic.

5 THE WITNESS: Yes. The intent here was not to deprive these labs from further work, but to allow them sufficient time to upgrade themselves to an acceptable level.

10 Phase two -- and, of course, if a positive was found within these labs for a national athlete, we did request them to send the residue of the A sample as well as the B for confirmation to a fully accredited lab. That was phase one, and it lasted for four months.

15 Phase two, labs were allowed to accept samples from athletes participating in international competitions with the provision that the A -- the potentially positive A sample and a B sample be analyzed by a fully accredited lab.

20 Q. So, can I just stop you there. So, Indianapolis is in the phase now that if they were testing for an international meet such as was held in New York a couple of weeks ago, and they found the presence of say Stanazolol on the A sample, the B sample would have to be checked by another IOC accredited lab before a positive
25 finding was made?

A. That is correct, yes.

Q. And what you were telling the Commissioner a few minutes ago at the meeting in Nice in early June of your sub-commission, you voted in favour of moving the suspension along to stage two, upgrading the lab into the stage 2 of Indianapolis?

A. That is correct, yes.

Q. But going back to the meeting in Cologne in February of 1989 this year when Indianapolis was suspended, you were part of the consensus that agreed that Indianapolis should be suspended and prevented from testing athletes who were participating in international meets, correct?

A. I don't -- again, a consensus did develop, you are right. I don't recall any active participation at that moment.

Q. Then Calgary was suspended at that meeting in Cologne in first week of February of '89. And are you telling us you didn't -- there was a consensus developed in the same way, but you didn't participate in the consensus concerning Calgary or was that a vote or what?

A. No, I don't recall there was a vote. You might get a better recollection from someone else, but I don't remember there was a formal vote. It was just

again a consensus. I did not -- I do not recall having spoken very much.

And, you know, international meetings of this nature do not work according to the sometimes rules of committee procedures, but the final decision, mind you, was taken by the Chairman of the Medical Commission, Prince de Merode.

Q. And I take it in any event that the meeting, the meeting in Cologne that determined the suspension of these various labs involved Beckett, Catlin, Clausnitzer, Donike, Dugal, Semenov of the Soviet Union, and Prince de Merode, is that it?

A. Prince de Merode came only on the second or third day of that particular meeting. He had other commitments. Professor Donike was chairing the meeting in his absence.

MR. ARMSTRONG: Then, Mr. Commissioner, I know you have a meeting at four o'clock, I am going on to one other area that will take me past four o'clock. I am in your hands.

THE COMMISSIONER: Well, we will adjourn until tomorrow morning at 10 o'clock. Thank you. Tomorrow at 10.

--- Whereupon the proceedings adjourned until Wednesday, August 2, 1989, at 10:00 a.m.

